FIELDBUS MODULE MFW-01 Series

USER

MANUAL

MFW-01

CODE 0899.4701 E/4

USER MANUAL MFW-01

Series: MFW-01
Software: version 2.xx
0899.4701 E/4

☞ **NOTE!**
It is very important to
check if the Software
Version is the same as
Indicated above.

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This manual contains all necessary information for the correct use of the MFW-01. Only qualified personnel familiar with this manual should attempt to start-up or troubleshoot this equipment.

1.1 SAFETY NOTICES IN THE MANUAL

The following safety notices will be used in this manual:

DANGER!
If the recommended safety Instructions are not strictly observed, it can lead to serious or fatal personal injuries and/ or equipment damage.

ATTENTION!
Failure to observe the recommended safety procedures can lead to material damage.

NOTE!
The content of this manual supplies important information for the correct understanding of operation and proper operation of the equipment.

1.2 SAFETY NOTICES ON THE PRODUCT

The following symbols may be attached to the product, serving as safety notice.

High Voltages.

**Components sensitive to electrostatic discharge.
Do not touch them without following proper grounding procedures.**

Mandatory connection to ground protection (PE).

Shield connection to the ground.

1 SAFETY NOTICE

1.3 PRELIMINARY RECOMMENDATIONS

DANGER!

Only qualified personnel familiar with communication networks should plan or implement the installation, start-up operation and maintenance of this equipment.

These personnel must follow all safety instructions included in this manual and/or defined by local regulations.

Failure to comply with these instructions may result in personal injury and/or equipment damage.

DANGER!

Do not open the equipment cover while equipment is connected to power supply.

Many components are charged with high voltage, even after supply voltage has been switched OFF. Wait at least 1 minute for the total discharge capacitor of the power supply.

Connect always the frame of the equipment to the ground (P.E.) at the suitable connection point.

ATTENTION!

All electronic boards have components that are sensitive to electrostatic discharges. Never touch any of the electrical components or connectors without following proper grounding procedures. If necessary to do so, touch before the properly ground metallic frame or use a suitable grounded strap.

> **Do not apply High Voltage (High Pot) test on MFW-01!**
> **If this test is required, contact the manufacturer.**

NOTE!

Communication networks are generally sensitive to interference generated by other equipment. To reduce this interference, adopt the measures recommended in this manual and in de manufacturer manual of the Fieldbus used.

2.1 ABOUT THIS MANUAL

This manual describes how to install, start-up, operate and identify problems with this equipment.

For more details, training or service request, contact WEG branch or representative.

NOTE!
When calling for information or requesting services, it is recommended that the following data are available:

þ MFW-01 type;

þ Serial number and manufacturing date as indicated on the product nameplate (see Item 2.5);

þ Version of the installed software (see Item 2.2).

2.2 MANUAL/ SOFTWARE VERSION

Due to constant technical improvements, for instance, the introduction of new functions, the MFW-01 may be supplied with a new installed software version. Please find on the cover sheet of this manual the software version to which this manual refers .

The software version is shown on the label attached on the microcontroller (D1) of the control board (CCF1).

NOTE!
Be sure to use the manual or appendix corresponding to the software version.

2 INTRODUCTION

2.3 INTRODUCTION TO NETWORK SERIAL COMMUNICATION

The main purpose of the serial network communication is the physical connection of several equipment to one or more masters that will control all equipment connected to this network by one or two twisted pair cables only:

```
              ┌──────────────┐
              │   Master     │
              │ (CLP or PC)  │
              └──────────────┘
                     ⇕
    ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━
        ⇕              ⇕              ⇕
  ┌──────────┐   ┌──────────┐   ┌──────────┐
  │ Slave 1  │   │ Slave 2  │ ● ● ● │ Slave n  │
  └──────────┘   └──────────┘   └──────────┘
```
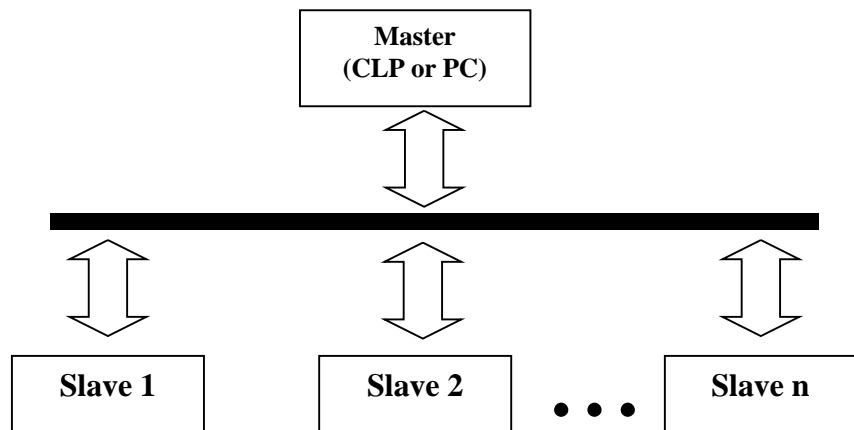
WEG equipment are fitted with a software that controls the data transmission/reception through the serial interface, thus enabling the reception of data sent by the master and the transmission of data requested by the master.

Related to each WEG equipment that is connected to the network, the master can realize the following operations:

þ Identifications;

þ Controls;

þ Status acknowledgement;

þ Parameter reading/changing;

As indicated in the respective serial communication manual of WEG equipment.

Typical application examples of WEG network:

• PC, monitoring simultaneously several variables of WEG equipment;

• PLC controlling the operation of several WEG equipment in an industrial process.

2.4 INTRODUCTION TO MFW-01

þ MFW-01, WEG Fieldbus Module, is an intelligent translator of communication protocols, a "gateway" among subnet formed by MFW-01 and equipments connected to it, and a Fieldbus communication network (Profibus-DP or DeviceNet). MFW-01 can translate part of the data between the two different protocols and program the data that should be exchanged.
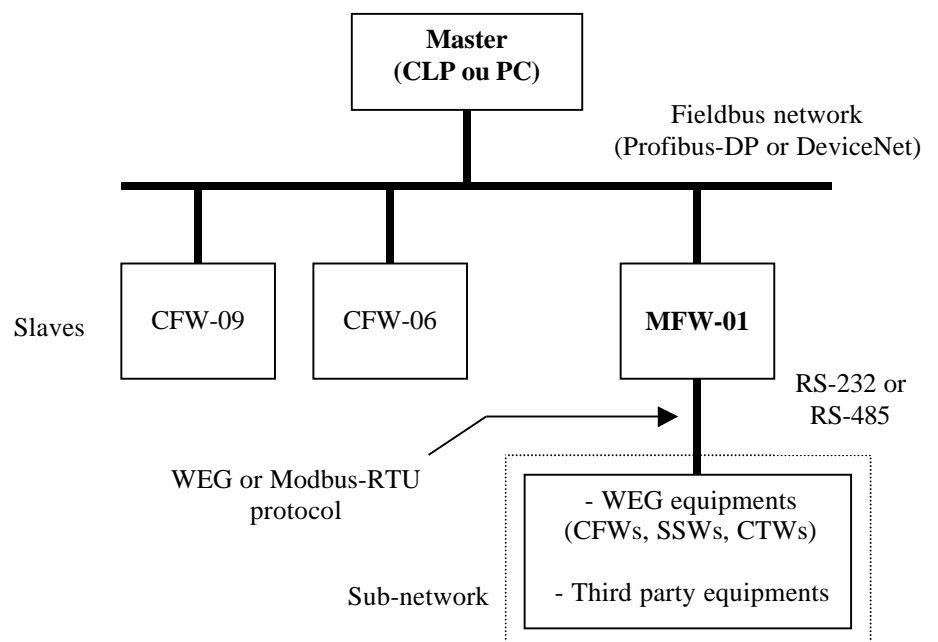
þ The programming of the data, parameters or basic variables of WEG equipment that should be available at high level, is realized by a software, MFW.exe v2.00 for MS-Windows, which has the capacity to configure which parameter or basic variable of WEG equipment should correspond to which address at the high Fieldbus communication network.

þ MFW-01 is fitted with a module called as Anybus that is supplied by HMS Fieldbus Systems AB. This company is associated with the certifying entities of the respective Fieldbuses that are being used.

þ Anybus module implements all Fieldbus, hardware and software communication protocols.

þ Besides the Anybus module, MFW-01 has: switched power supply, microcontroller, connection for EIA/RS-232 and EIA/RS-485 interfaces and six 24Vdc digital inputs and four digital relay outputs.

2 INTRODUCTION

þ The microcontroller is responsible for the serial acquisition and changing of the parameter content of subnet´s equipment according to chosen protocol (WEG or Modbus-RTU) and for updating variables in the Dual Port RAM.

þ The microcontroller also identifies which Fieldbus device is connected to realize the configuration of the addressing in the DPRAM variables.

þ The variables are allocated on the DPRAM by means of a addressing table resident on E2PROM, that must be configured previously by the PC configuration software, MFW.exe v2.00, and transferred to MFW-01 serially.

þ By means of this software the user can configure, according to his needs, which parameters shall be read or controlled.

þ Once the required configuration parameters are defined, they will be updated cyclically at their respective addresses. If a change of that configuration is required, the user can perform it through the new configuration.

þ Simplified block diagram of the MFW-01:
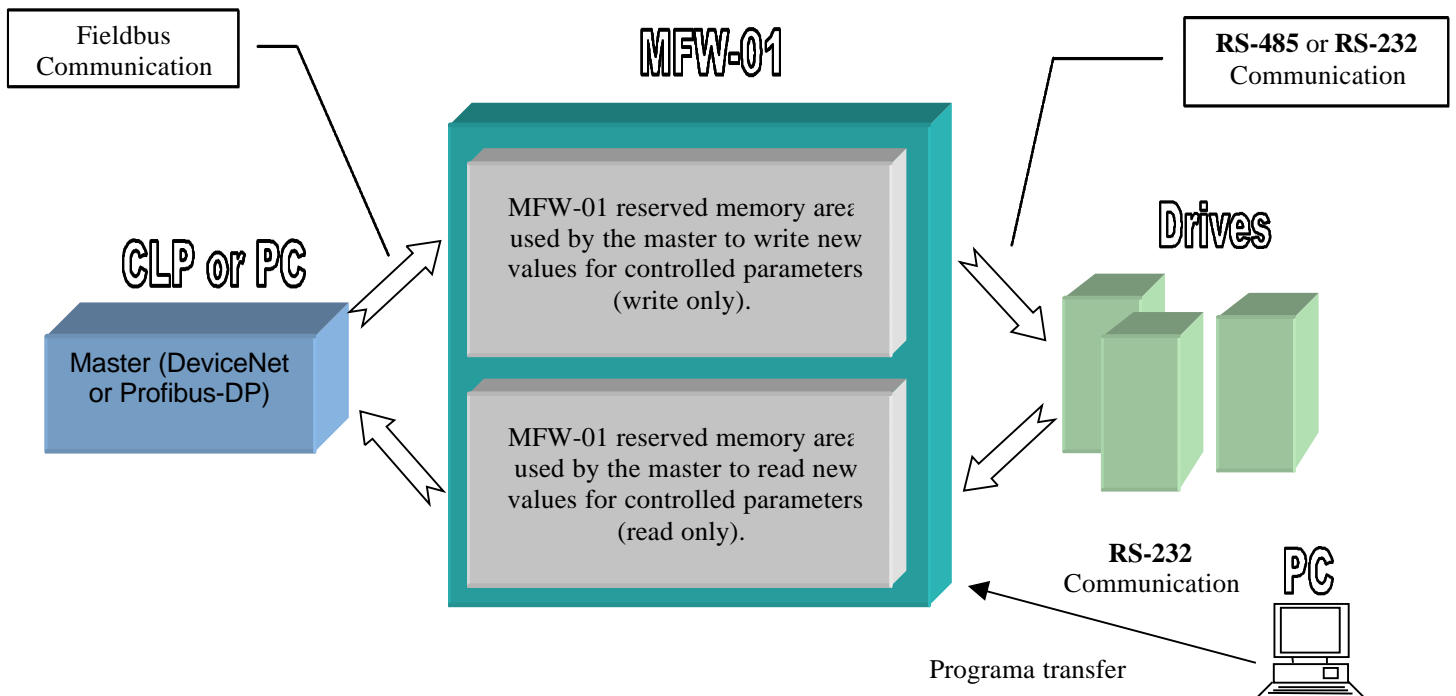
2.4.1 Mechanical Characteristics

All MFW-01 types are fitted with the same mechanics.
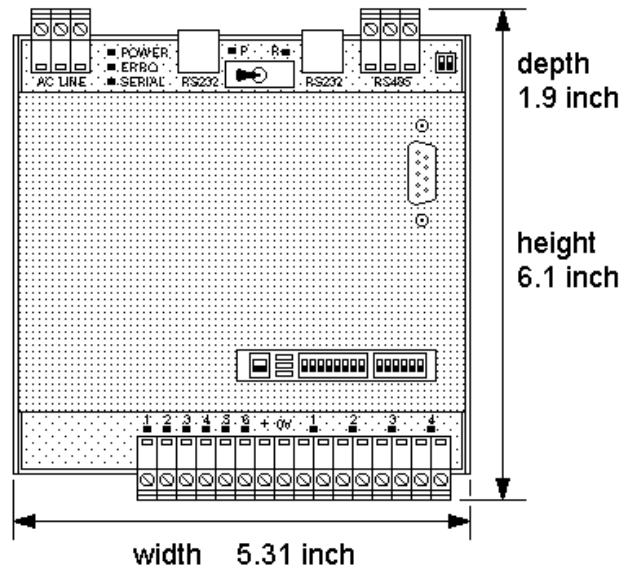
þ Galvanized steel sheets with fixture for fastening on DIN rails.

þ Degree of Protection: IP20.

þ Operation Temperature: 0ºC to 50ºC.

2.4.2 Mechanical Fastening

þ To fix the MFW-01 proceed as follows: insert firstly the top groove on the rail, then press it down against the wall till the lower side of the rail is inserted in the groove.

þ To remove it from the rail proceed as follows: press the top side down and maintain it depressed, then pull the bottom side out of the rail.

2 INTRODUCTION

2.5 PRODUCT IDENTIFICATION

MFW Type →

Power Supply Data →

← Hardware Version

← Serial Number / WEG item / manufacturing date

Identification nameplate

MFW-01 / _ _   Options: Item:
                 PD= Profibus-DP   417100540
                 DN= DeviceNet   417100541

2.6 RECEIVING, INSPECTION AND STORAGE

Check the following Items at product receipt:

þ If the MFW-01 data meet your required specification.

þ If the equipment has been damaged during the transport.

þ If the received product does not match the requested specification, or any damages or shortages are detected. contact immediately the manufacturer or our sales representative.

þ If the product will be stored after incoming inspections, keep it in its original packaging and store it in a suitable dry and clean room:

• do not store it in temperature higher than 60ºC (140ºF) and lower than −25ºC (13ºF) ;
• do not store it in wet room where water condensation can occur;
• do not store it in any corrosive environment.

3.1 MECHANICAL INSTALLATION

3.1.1 Environment

Location of MFW-01 is important to achieve proper performance and normal operating life. The unit should be installed in an area where it will be protected against:

þ direct exposure to sunlight, rain, moisture or sea air;

þ corrosive or explosive gases or liquids;

þ excessive vibration, airborne dust or metallic particles.

Environmental Conditions:

þ **Temperature :** 0 ... 40º C – nominal conditions.
0 ... 50º C – current rating of 2% for each 1,8ºF (1ºC) degree above 104ºF (40ºC).

þ **Relative Air Humidity**: 5% to 90%, non-condensing.

þ **Max. Altitude**: 3,300ft **(**1000m) – nominal conditions.

þ **Pollution Degree:** 2 (according to EN50178 and UL508C).

When MFW-01 are installed in panels or closed metal boxes, adequate cooling is required to ensure that the temperature around the unit will not exceed the maximum allowed temperature.

3.1.2 Mounting Specification

As shown in Item 2.4.2 – Mechanical Fastening.

þ Install MFW-01 in vertical position.

þ There must be a minimum of 2,0 in. on each side of the MFW-01.

þ Install the unit on a suitable flat surface.

þ Provide independent conduits or cable troughs to separate the serial interface, digital input and output and power conductors from the wiring of other equipment such as frequency inverters, motors, contactor, etc.

3 INSTALLATION

3.2 ELECTRICAL INSTALLATION

DANGER!
Be sure that the AC power supply is disconnected before making any terminal connection.

DANGER!
The information below will be a guide to achieve a proper installation. Follow also all applicable local standards for electrical installations.

ATTENTION!
Provide at least 10 in (0.25m) spacing between the equipment and the noise generator wiring and the serial interface and the digital I/O wiring of the MFW.

3.2.1 Power Connections
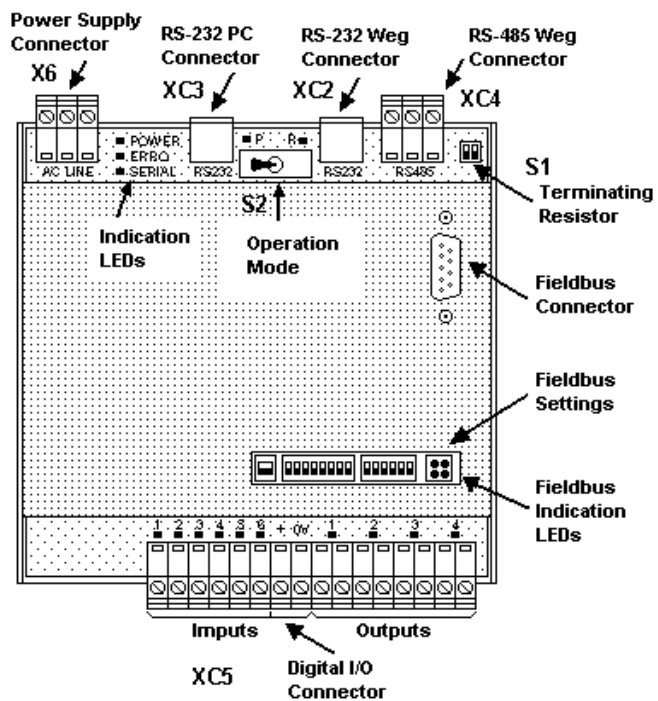
þ X6 AC LINE power supply connector.

þ EIA/RS-485 WEG XC4 connector for standalone or networked equipments (both protocols are supported).

þ EIA/RS-232 WEG XC2 connector for only one equipment (both protocols are supported).

þ EIA/RS-232 PC XC3 connector for the PC.

þ Operation mode selection switch S2, RUN or PROG.

• RUN for program running (led RUN);

- PROG for program transfer (led PROG).

þ Connecting switch S1 of the terminating resistor when end of line (RES. to 485).

þ Digital input/output connector XC5.

þ Fieldbus connector.

þ Configuration switches of the Fieldbus, addressing, transfer rate, terminating resistor can be configured according to the used protocol.

þ Indication leds and Fieldbus indication leds.

3.2.2 Power Supply

MFW-01 has a switched power supply that supplies the internal electronics and the serial communication interfaces.
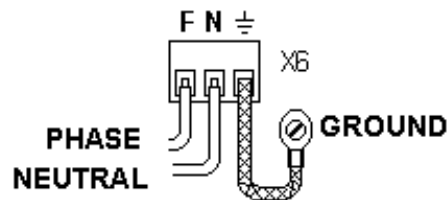
3.2.3 Characteristics of the Power Supply

þ Supply voltage: 85 to 240Vac rms.

þ Max. power consumption: 17 Watts.

þ Internal fuse: 2A / 250V delayed actuation (5x20mm tubular glass).

þ Electromagnetic Compatibility: fitted with a filter for interference reduction according to EN50081-1 / EN55011 Class B CISPR11 Class B for .

3.2.4 Description of the X6 Connector

þ MFW-01 connector of the X6 power supply.

þ Max. torque for connector screws: 0.3Nm.

þ Connector duty data: 250Vac 2A.

þ Cable cross-section: 0.5...1.5mm².

TERMINAL	SYMBOL	DESCRIPTION
1	F	Phase (85-240Vac)
2	N	Neutral
3	Ground	Pin 3 must be grounded.

3.2.5 Digital Inputs and Outputs

See Item 7.

3.2.6 Serial Interfaces

See Item 6.

3.2.7 Grounding

Due to safety reasons, the MFW must be always solidly grounded. The grounding connection must meet the local regulations.

þ For grounding use a wire cross-section of min. 1.5mm².

þ Connect the grounding cable to a specific grounding bar or to the general grounding point (resistance $\leq$ 10 ohms).

þ Do not share the grounding wiring with other equipment that operates at high powers (for instance, high voltage motors, welding machines, etc.).

þ If several equipment are connected through their serial interfaces, connect them to the same ground.

NOTE!
Avoid to connect the equipment to different grounding points, since they can have different voltages and when they are connected through their serial interfaces, these voltage differences can damage the equipment.
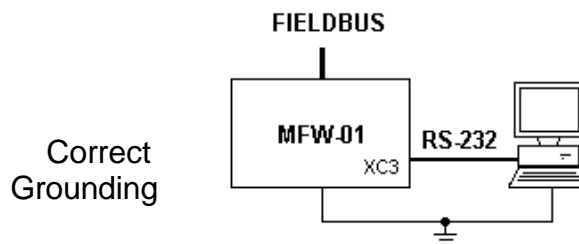
Correct Grounding

ATTENTION!
Do not use the neutral conductor for grounding purpose.
For long distances, use always EIA/RS-485 interfaces.

4.1 INDICATIONS

Indicator Leds:

þ Power Led: lights up when MFW-01 ON.

þ Serial Led: is ON when MFW-01 is transmitting or receiving data serially to or from any of their serial interfaces   .

þ Error Led: lights up when any error is present.

Indication Leds of operation mode:

þ Prog Led: lights up in programming mode for program transfer;

þ Run Led: lights up when program is running.

Leds for indication of digital Inputs/Outputs:

þ Each I/O is fitted with one led;

þ Leds lights up when input (+24V) and output is activated (contact closed).

þ The error led will flash according to the existing error code (firmware version 2.xx):
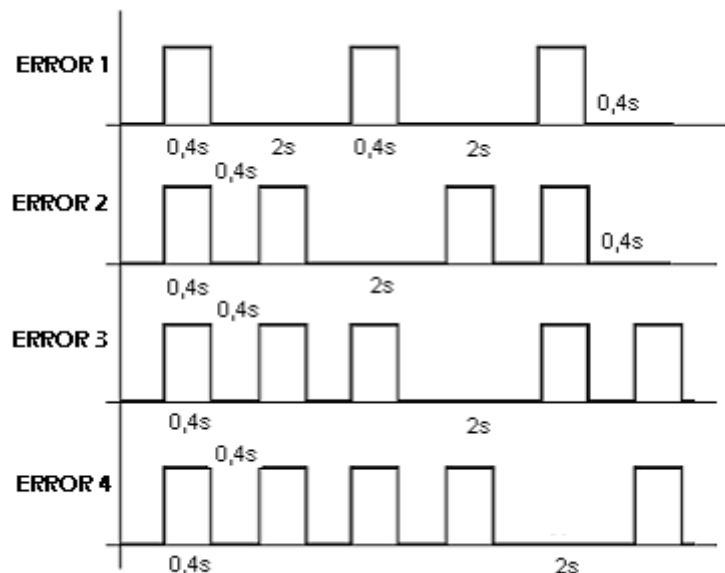
- Error 1 = timeout error, there is no answer to the frame sent to one of the equipment connected to the subnet or answer frame with some kind of error;
- Error 2 = in RUN mode without I/O configuration;
- Error 3 = access error to dual port RAM or Fieldbus. AnyBus board may be not connected or it is defective;
- Error 4 = initialization error of the AnyBus.

5 DEFINITIONS

5.1 SUB-NETWORK

Þ MFW-01 has the advantage to be connected to several equipments (WEG products or not) building, this way, a subnet in EIA/RS-232 or EIA/RS-485 whose higher protocols can be chosen between WEG (available in WEG products only) and Modbus-RTU.

Þ The maximum number of available stations on this subnet will depend on the number of the required variables and on the time required for their updating.

Þ The max. allowed number of variables is of 48 inputs and 48 outputs. Each variable is a word with 16bits.

Þ The stations connected to this subnet can be different WEG equipments: CFWs, SSWs, CTWs, or even third party equipments if Modbus-RTU protocol is being used.

Þ Through the equipment response to each answering frame or to the variable change, MFW-01 will check which equipment are operating correctly. This information will be available at the specific addresses of the DPRAM input that will be made available at the higher network.

Þ The available DPRAM variables for the communication between the Master and the MFW-01 are so disposed to service several Fieldbus protocols, make easy and viable the implementation of the software on the PLC or on PC and to establish the communication with all WEG equipment that have WEG serial communication protocol.

Þ O MFW-01 controls the variables of all equipment independent of the type or their number. The variable communication will be realized only through their respective addresses:

5.1.1 Main Terms Used

Þ Parameters: are those existing in WEG equipment which display or change is possible through the HMI (Human Machine Interface);

Þ Variables: are values that have specific functions in WEG equipment and that can be read and, in some cases, modified by the master;

Þ Basic variables: are those variables that can be accessed only through the serial interface.

5.1.2 Block Diagram
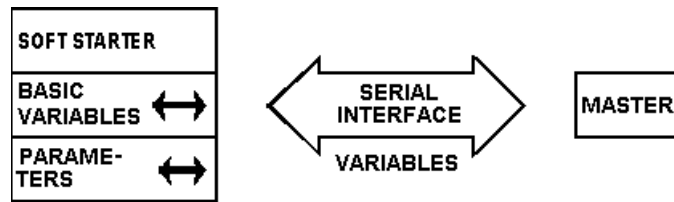
5.1.3 Variable Standardization

The variable exchange is subject to different standardization, which depend of the WEG equipment that are used.

5.1.4 Parameters Related to Serial Communication

All WEG equipment have parameters related to the enabling and disabling functions of the serial communication. Thus you must read carefully all user manuals of the respective serial communications.

5.2 WEG PROTOCOL

- The protocol for WEG network is here described in a simplified manner for demonstration purpose only;
- The user shall not worry about the assembling, receiving and processing of the frames in the subnet, but only about the processing of the data that are available for the high network in Fieldbus;
- For the data processing, the user shall read all hardware and serial communication manuals of the respective WEG equipment that are being used.

The error monitoring is realized trough the transmission related to the individual character parity of 7 bits, according to ISO 646.

The parity monitoring is realized according to DIN 66219, even parity. MFW-01 use two messages types:

þ READ FRAME: for inquiring of the variable content of WEG equipment;

þ WRITE FRAME: to change the variable contents or to send controls to WEG equipment.

5 DEFINITIONS

5.2.1 Read Frame

This frame allows MFW-01 receiving from WEG equipment the content that corresponds to the request.

þ In the answer frame, the equipment transmits the data requested by MFW-01.

5.2.2 Write Frame

This frame sends data to the variables of WEG equipment.

þ The equipment will answer, indicating if the data have been accepted or not.

5.2.3 Frame Testing

All equipment and MFW-01 test the frame syntax.

The answers for the respective found conditions:

þ **Read Frame:**

- Without answer: the received control characters are wrong or the address of WEG equipment is wrong;
- NAK: Code corresponding to the existing variable or the variable is only write variable;
- TEXT: with valid frames.

þ **Write Frame:**

- Without answer: the received control characters are wrong or the address of WEG equipment is wrong;
- NAK: Code corresponding to the no existing variable or the variable is only read variable, value out of range and not allowed for this variable, operation parameter is not in changing mode;
- ACK: with valid frames.

NOTE!
If there are frames **without answer** and/or **NAK,** MFW-01 will set a specific bit in the DPRAM indicating that one of these errors has been occurred with the master.

5.2.4 Errors Related to the Serial Communication

þ They do not disable WEG equipment;

þ They do not deactivate the fault relay;

þ They inform only through display and in logical status word.

Type of Errors:

- **E22:** longitudinal parity error (BCC);
- **E24:** when changing of parameters is attempted that can not be changed with running motor;
- **E25:** not existing variable;
- **E26:** set value out of permitted range;
- **E27:** write attempt on read-only variable, or logical control disabled;
- **E29:** serial interface error (available only in some WEG equipment).

PS:
These errors can be observed through reading of the status variable of WEG equipment.

NOTE!
Take care with the parameter incompatibility. Function incompatibilities are indicated in the respective manuals of WEG equipment that are being applied.

5.2.5 Times in the Subnet (WEG Protocol)

Variable updating times at dual port RAM:

þ As the communication between WEG equipment and the MFW-01 is serial, the variable updating rate at DPRAM depends of the serial baud rate of WEG equipment.

þ The standard baud rate of WEG equipment is 9600bps. This baud rate reduces the time of the DPRAM variable updating, but does not reduce the communication time of the Fieldbus network, since the variables are always available at the Fieldbus network, updated or not.

þ Times of WEG protocol:

Data receiving/transmission rate: 9600bps	1bit / 104,2us
Each data word has 10bits	1,04ms
A inquiry frame has 8 word	8,33ms
A answering frame to a inquiry has 14 word	14,58ms
A changing frame has 15 word	15,63ms
A answering frame to a change has 2 words	2,08ms
An updating of a requested variable (with immediate answer)	22,91ms
A changing of a write variable (with immediate answer)	17,71ms

5 DEFINITIONS

Note.:

- For each frame without answer will occurs a delay of 100ms.

- The same frame will be sent up to two times consecutively, 200ms, after that an error will be indicated on the respective status word, (set bit).

- As the variables are processed cyclically, a new processing is realized.

- When at the next processing the answer is correct, the respective status word is reset (reset bit).

NOTE!

- In order to avoid communication delay, maintain all WEG equipment ON and disconnect defective equipment immediately from the sub-network.

- All drivers and their connections with communication network must be in excellent operation condition and submitted to preventive maintenance in determined intervals.

- The total updating time of the DPRAM variables depends on the number of variables that should be processed.

þ Simplified diagram of the variable processing:

Initialization

It updates the digital inputs/outputs
Must process the serial transmission?

Yes	No

It reads the description of the "n" input variable at the EEPROM
It generates an inquiry frame of the "n" input variable
It sends an inquiry frame of the "n" input variable
I receives the answer of the "n" input variable
It updates at DPRAM the "n" input variable and status word
It updates the digital inputs/outputs
It increments "n + 1"
The inputs are processed up to the last variable

It updates the digital outputs
Must the outputs be processed?

Yes	No

Are there new data for the outputs?

Yes	No

It reads the description of the "n" output variable at the EEPROM
It reads the content of the "n" output variable at the DPRAM
It reads the value of the digital outputs at DPRAM and updates the digital outputs
It generates an inquiry frame of the "n" output variable
It sends an inquiry frame of the "n" output variable
I receives the answer of the concluded change
It updates at DPRAM the status word and the digital inputs
It increments "n + 1"
The outputs are processed up to the last variable

þ Since the initialization, the MFW-01 working cycle follows always this flowchart, processing firstly all read variables and then all write variables, returning cyclically to the first read variable.

Note:
"n" shown above is used only to exemplify the sequential address of the variable processing: first variable, second variable...

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þ The total updating time can be obtained by the following equation:

Time = (number of input variables x (22,91ms + 1,2ms)) + (number of output variables x (17,71ms + 1,2ms))

Note:
Do not consider the status variables in the number of input variables, that they will be used according to the number of used blocks. See DPRAM Definition Table.

þ Please consider only the output times in the total sum when they have been changed.

NOTE!
This time will be maintained, when no communication error occurred with WEG equipment that are part of subnet.

þ The digital inputs are updated at every DPRAM access. Thus the max. updating time of the digital inputs is 22,91ms, but when communication error has occurred, this time will be extended in 100ms.

þ The digital outputs are only updated when a data change is made. Thus the maximum updating time of the digital outputs after a data change may be 22,91ms, but when communication error has occurred, this time will be of 100ms.

5.3 MODBUS-RTU PROTOCOL

- It´s described in a simplified manner for demonstration purpose only. This section should be used as a quick reference guide, not as a complete specification of the protocol.

- The implementation made use two types of Modbus-RTU telegrams, one for reading (0x03 function) and another for writing (0x06 function) parameters./basic variables.

- Each byte of the transmitted telegram is associated with a parity byte whose goal is to guarantee data integrity. One can choose among none, even or odd parity type in the configuration software MFW.exe v.200.

- Besides, each transmitted Modbus-RTU telegram is associated with two other bytes, CRC (Cyclical Redundancy Checking), which is calculated over all

message. CRC guarantees that the telegram wasn´t corrupted during transmission.

5.3.1 Read Holding Registers Function (0x03)

- Function implemented as a reading telegram and used to read parameters and basic variables.
- In this function, registers are addressed from zero (0x0000).
- Parameters are available starting from zero (0) and basic variables from 5000 (decimal).
- Implementation made allows reading of only one variable by telegram.

Parameters		
No. Parameter	**Modbus Address**	
	Decimal	**Hexadecimal**
P000	0	0000h
P001	1	0001h
…	…	…
P100	100	0064h

Basic Variables		
No. Basic Variable	**Modbus Address**	
	Decimal	**Hexadecimal**
V00	**5000**	**1388h**
V01	**5001**	**1389h**
…	…	…
V05	**5005**	**138Dh**

5.3.2 Write Single Register Function (0x06)

- Function implemented as a writing telegram and used to write new parameters and basic variables values.
- In this function too, registers are addressed from zero (0x0000).
- Parameters are available starting from zero (0) and basic variables from 5000 (decimal).
- Only one register (parameter and basic variable) can be written each time.

NOTE!
All registers (parameters and basic variables) are considered as holding type, addressed from 40000 or 4x, as specified by the protocol.

5 DEFINITIONS

5.3.3 Times in the Subnet (Modbus-RTU Protocol)

Variable updating times at dual port RAM:

þ As the communication between subnet equipments and the MFW-01 is serial, the variable updating rate at DPRAM depends of the equipment´s seria baud rate.

þ The standard baud rate of Modbus-RTU equipments are 19200bps. A lower value, like 9600bps, can be chosen. Despite this, the communication time of the Fieldbus network are not affected, since the variables are always available at the Fieldbus network, updated or not.

þ Times of Modbus-RTU protocol (19200bps baud rate):

Data receiving/transmission rate: 19200bps	1bit / 52,08us
Each data word has 11bits	0,573ms
An inquiry frame has 8 words	4,58ms
An answering frame to na inquiry has 7 words	4,01ms
A changing frame has 8 words	4,58ms
An answering frame to a change has 8 words	4,58ms
An updating of a requested variable (with immediate answer)	8,59ms
A changing of a write variable (with immediate answer)	9,16ms

PS:
- For each frame without answer will occur a delay of the time programmed in timeout field of MFW.exe v2.00 software.

- The same frame will be sent up to two times consecutively, 2 x timeout value, after that an error will be indicated on the respective status word, (set bit).

- As the variables are processed cyclically, a new processing is realized.

- When at the next processing the answer is correct, the respective status word is reset (reset bit).

NOTA!
- In order to avoid communication delay, maintain all equipment ON and disconnect defective equipment immediately from subnet.

- All drivers and their connections with communication network must be in excellent operation condition and

submitted to preventive maintenance in determined intervals.

- The total updating time of the DPRAM variables depends on the number of variables that should be processed.

þ The total updating time can be obtained by the following equation:

Time = (number of input variables x 8,59ms) + (number of output variables x 9,16ms)

Obs.:
Do not consider the status variables in the number of input variables, that they will be used according to the number of used blocks. See DPRAM Definition Table.

þ Please consider only the output times in the total sum when they have been changed.

þ This equation didn´t take in account execution instruction´s time, thus, total time will be some few microseconds greater than the result of the above equation.

NOTE!
This time will be maintained, when no communication error occurred with any equipment that are part of subnet.

þ The digital inputs are updated at every DPRAM access. Thus the max. updating time of the digital inputs is 8,59ms, but when communication error has occurred, this time will be extended to the value programmed in timeout field.

þ The digital outputs are only updated when a data change is made. Thus the maximum updating time of the digital outputs after a data change may be 9,16ms, but when communication error has occurred, this time will be of timeout value.

5.4 ADDRESSING

þ Table below shows the addressing of the DPRAM variables and how the master will access the variables:

5 DEFINITIONS

<table>
<tr><td colspan="6" align="center">Addressing of the DPRAM Variables</td></tr>
<tr><td colspan="3" align="center">Inputs</td><td colspan="3" align="center">Outputs</td></tr>
<tr><td>Addr.</td><td></td><td align="center">Definitions</td><td>Addr.</td><td></td><td align="center">Definitions</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>0</td><td></td><td align="center">Status from Digital Inputs</td><td>0</td><td></td><td align="center">Status to Digital Outputs</td></tr>
<tr><td>1</td><td></td><td align="center">General Status</td><td>1</td><td></td><td align="center">Control</td></tr>
<tr><td colspan="3" align="center">1st input block</td><td colspan="3" rowspan="3" align="center">1st output block</td></tr>
<tr><td>2</td><td></td><td align="center">Status from 1st input block</td></tr>
<tr><td>3</td><td></td><td align="center">Status from 1st output block</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>L</td><td rowspan="2" align="center">Content from variable no. 1</td><td>2</td><td>L</td><td rowspan="2" align="center">Content to variable no. 1</td></tr>
<tr><td>5</td><td>H</td><td>3</td><td>H</td></tr>
<tr><td>6</td><td>L</td><td rowspan="2" align="center">Content from variable no. 2</td><td>4</td><td>L</td><td rowspan="2" align="center">Content to variable no. 2</td></tr>
<tr><td>7</td><td>H</td><td>5</td><td>H</td></tr>
<tr><td colspan="3" align="center">Total of 8 input variables</td><td colspan="3" align="center">Total of 8 output variables</td></tr>
<tr><td>18</td><td>L</td><td rowspan="2" align="center">Content from variable no. 8</td><td>16</td><td>L</td><td rowspan="2" align="center">Content to variable no. 8</td></tr>
<tr><td>19</td><td>H</td><td>17</td><td>H</td></tr>
<tr><td colspan="3" align="center">2nd input block</td><td colspan="3" rowspan="3" align="center">2nd output block</td></tr>
<tr><td>20</td><td></td><td align="center">Status from 2nd input block</td></tr>
<tr><td>21</td><td></td><td align="center">Status from 2nd output block</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>22</td><td>L</td><td rowspan="2" align="center">Content from variable no. 9</td><td>18</td><td>L</td><td rowspan="2" align="center">Content to variable no. 9</td></tr>
<tr><td>23</td><td>H</td><td>19</td><td>H</td></tr>
<tr><td>24</td><td>L</td><td rowspan="2" align="center">Content from variable no. 10</td><td>20</td><td>L</td><td rowspan="2" align="center">Content to variable no. 10</td></tr>
<tr><td>25</td><td>H</td><td>21</td><td>H</td></tr>
<tr><td colspan="3" align="center">Total of 8 input variables</td><td colspan="3" align="center">Total of 8 output variables</td></tr>
<tr><td>36</td><td>L</td><td rowspan="2" align="center">Content from variable no. 16</td><td>32</td><td>L</td><td rowspan="2" align="center">Content to variable no. 16</td></tr>
<tr><td>37</td><td>H</td><td>33</td><td>H</td></tr>
<tr><td colspan="3" align="center">3rd input block</td><td colspan="3" rowspan="3" align="center">3rd output block</td></tr>
<tr><td>38</td><td></td><td align="center">Status from 3rd input block</td></tr>
<tr><td>39</td><td></td><td align="center">Status from 3rd output block</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>40</td><td>L</td><td rowspan="2" align="center">Content from variable no. 17</td><td>34</td><td>L</td><td rowspan="2" align="center">Content to variable no. 17</td></tr>
<tr><td>41</td><td>H</td><td>35</td><td>H</td></tr>
<tr><td>42</td><td>L</td><td rowspan="2" align="center">Content from variable no. 18</td><td>36</td><td>L</td><td rowspan="2" align="center">Content to variable no. 18</td></tr>
<tr><td>43</td><td>H</td><td>37</td><td>H</td></tr>
<tr><td colspan="3" align="center">Total of 8 input variables</td><td colspan="3" align="center">Total of 8 output variables</td></tr>
<tr><td>54</td><td>L</td><td rowspan="2" align="center">Content from variable no. 24</td><td>48</td><td>L</td><td rowspan="2" align="center">Content to variable no. 24</td></tr>
<tr><td>55</td><td>H</td><td>49</td><td>H</td></tr>
<tr><td colspan="3" align="center">4th input block</td><td colspan="3" rowspan="3" align="center">4th output block</td></tr>
<tr><td>56</td><td></td><td align="center">Status from 4th input block</td></tr>
<tr><td>57</td><td></td><td align="center">Status from 4th output block</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>58</td><td>L</td><td rowspan="2" align="center">Content from variable no. 25</td><td>50</td><td>L</td><td rowspan="2" align="center">Content to variable no. 25</td></tr>
<tr><td>59</td><td>H</td><td>51</td><td>H</td></tr>
</table>

Input blocks

Addr	L/H	Description
60	L	Content from variable no. 26
61	H	
		Total of 8 input variables
72	L	Content from variable no. 32
73	H	
		5th input block
74		Status from 5th input block
75		Status from 5th output block
76	L	Content from variable no. 33
77	H	
78	L	Content from variable no. 34
79	H	
		Total of 8 input variables
90	L	Content from variable no. 40
91	L	
		6th input block
92		Status from 6th input block
93		Status from 6th output block
94	L	Content from variable no. 41
95	H	
96	L	Content from variable no. 42
97	H	
		Total of 8 input variables
108	L	Content from variable no. 48
109	L	

Output blocks

Addr	L/H	Description
52	L	Content to variable no. 26
53	H	
		Total of 8 output variables
64	L	Content to variable no. 32
65	H	
		5th output block
66	L	Content to variable no. 33
67	H	
68	L	Content to variable no. 34
69	H	
		Total of 8 output variables
80	L	Content to variable no. 40
81	L	
		6th output block
82	L	Content to variable no. 41
83	H	
84	L	Content to variable no. 42
85	H	
		Total of 8 output variables
96	L	Content to variable no. 48
97	L	

5.4.1 Detailed DPRAM Description

þ Detailed description of the definitions of each DPRAM address:

þ **Status from digital inputs:** Current status of the MFW-01 digital inputs.

7	6	5	4	3	2	1	0
X	X	Digital Input 6	Digital Input 5	Digital Input 4	Digital Input 3	Digital Input 2	Digital Input 1

- Bit high = activated digital input.

þ **General Status:** shows the status of some current conditions of the MFW-01.

5 DEFINITIONS

7	6	5	4	3	2	1	0
X	X	X	Without user program	Error in a writing	Error in a reading	1st reading realized	Initialization concluded

- Initialization concluded: this bit, high when, indicates that the initialization of the Fieldbus has been realized, it is connected and it is without error.
- 1st reading realized: this bit, high when, indicates that the first reading of all input variables has been realized with or without communication error.
- Error in a reading: this bit is high when an answer error with NAK occurs, or when the corresponding driver does not answer after two reading attempts of the input variable. The timeout will be 100ms x 2 =100ms if WEG protocol is being used and 2 x timeout value for Modbus-RTU protocol.
- Error in a writing: this bit is high when an answer to NAK occurs or when the corresponding driver does not answer after two changing attempts of the output variable. The timeout will be 100ms x 2 =100ms for WEG protocol and 2 x timeout value for Modbus-RTU.
- Without user program: this bit, high when, indicates that there is no correct input or output configuration at E2PROM.

þ **Status of the "n" input block:** it is used to indicate when a communication error occurs during the status request of each variable.

7	6	5	4	3	2	1	0
Error in the answer of variable 8	Error in the answer of variable 7	Error in the answer of variable 6	Error in the answer of variable 5	Error in the answer of variable 4	Error in the answer of variable 3	Error in the answer of variable 2	Error in the answer of variable 1

- Bit high = answer to request with NAK or without answer.

- It is considered error after three attempts without success.
- Each status word corresponds to a block of 8 variables of the input area, respectively.
- Status is reset if the next reading of the same variable is OK.

þ **Content from variable "n":** after the reception of each answer, MFW-01 writes the content of the variable in this DPRAM address.

- The variable content is divided into two bytes: L = LSB and H = MSB and the addressing is defined according to

the communication protocol.
- When a communication error occurs in the sub-network, the variable stores the last received value.

þ **Status of the "n" output block:** it is used to indicated when a communication error occurs during the status changing of each variable

7	6	5	4	3	2	1	0
Error during changing of variable 8	Error during changing of variable 7	Error during changing of variable 6	Error during changing of variable 5	Error during changing of variable 4	Error during changing of variable 3	Error during changing of variable 2	Error during changing of variable 1

- Bit high = answer to changing with NAK or without response.

- Each status word corresponds to a block of 8 variables of the output area, respectively.
- It is reset if the next writing of the same variable is OK.

þ **Status to digital outputs:** status that the master will write at the digital outputs of the MFW-01.

7	6	5	4	3	2	1	0
X	X	X	X	Digital output 4	Digital output 3	Digital output 2	Digital output 1

- Bit high = activates digital output

þ **Control:** through this byte the master can control the communication in the subnet between the MFW-01 and the connected drivers.

7	6	5	4	3	2	1	0
X	X	X	X	X	Enables the changes always	Enables the changes	Enables the communication

- Bit high = activates the function.

- It enables the communication: if the master set this bit, the communication in the subnet is started, enabling the reading of the inputs and allowing the change enabling.
- It enables the changes: if the master set this bit, the communication in the subnet is started, enabling to write the outputs. To enable changes, previous bit (enables

5 DEFINITIONS

the communication) must set too.

- It enables the changes always: if the master set this bit, the communication in the subnet is started, enabling to write the outputs always. Independently if outputs changed from master. The total updating time will increase. Once again, this option requires two previous bit high (bits 0 and 1 to high).

If this timer is enabled, the bit number 6 of the control byte is reserved to be continuously changed. Doing this, the timer will detect this change, and MFW-01 will not be disabled.

During the programmed time, if MFW-01 doesn't receive any new data, it will consider that the Modbus-RTU communication is not available anymore, and it will reset the digital outputs and the serial communication will stop. Once the communication is reestablished, MFW-01 will return to normal work.

þ **Content to variable "n":** MFW-01 will fetch the content of this DPRAM memory area and will write it cyclically in the respective variable of respective WEG equipment.

- The content of the variable is divided into two bytes: L = LSB and H = MSB . Its addressing is defined according to the communication protocol.

5.5 OPERATION MODES

Detailed definitions of MFW-01 operation mode:

þ MFW-01 is fitted with a selector switch of the operation mode, defining the PROG or RUN mode.

- When set in PROG mode, MFW-01 waits only for the program transfer request with an own protocol for this transfer.

- In RUN mode there is no communication with the PC for the configuration transfer, nor answer to the transfer request.

þ After total and correct reception of all input and output configurations, MFW-01 waits, while in PROG mode, for the sending of new configuration.

þ After total and correct reception of the I/O configuration,

MFW-01, when set to RUN mode, realizes the initialization process.

þ After power up if when MFW-01 is set to RUN mode, it will check firstly if the content of E2PROM is ok:
• If the content of E2PROM is not correct, it will remain in loop, indicating through the respective error led: without configuration;
• If the configuration is correct, MFW-01 waits for 3s, to start all drivers connected to the subnet.

þ Initialization process:
• After verification and the configuration at E2PROM is correct, the initialization of the AnyBus DPRAM will be realized, identifying the protocol type and starting the inquiry frames and the variables changing.

The physical connection between equipment (WEG or not) and the MFW-01 of the subnet is realized in two standard ways:

þ EIA/RS-232 point to point up to é 10m;

þ EIA/RS-485 multi-point, with galvanic insulation, up to 1000m;

6.1 EIA/RS-485 WEG INTERFACE

To be used in the subnet formed by MFW-01 and all drives connected to it. It works with both protocols (WEG and Modbus-RTU).

6 COMMUNICATION INTERFACES

```
                    ┌──────────┐
                    │  MFW-01  │
                    └────┬─────┘
                         │
                         │      ┌───────┐      ┌──────────┐
                         ├──────│ MIW-02│──────│  CFW-08  │
                    RS-485      └───────┘      └──────────┘
                         │
                         │      ┌───────┐      ┌──────────┐
                         ├──────│ MIW-02│──────│  SSW-05  │
                         │      └───────┘      └──────────┘
                         │
```
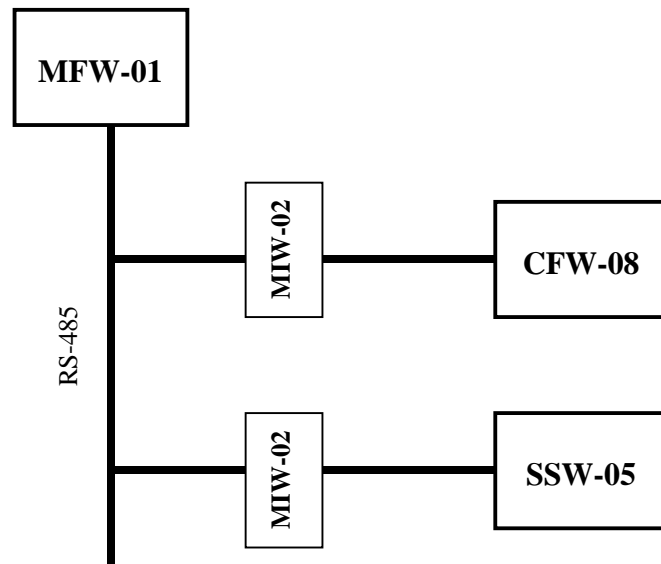
þ The EIA/RS-485 interface allows the interconnection of several devices to one MFW-01 (master), atributting a valid address to each equipment.

þ The connection of the participants is realized by means of a twisted pair cable.

þ The signal levels are according to EIA/RS-485 with differential receiver and transmitter.

NOTE!
If equipment is fitted only with the standard EIA/RS-232 interface, you must couple an level conversion module to convert the level from EIA/RS-232 to EIA/RS-485, designated as MIW-02 interface module for EIA/RS-232 | EIA/RS-485 communication and a communication cable for EIA/RS-232.

6.1.1 EIA/RS-485 WEG Electrical Characteristics

ↄ **EIA/RS-485:**

- **Standard:** EIA/RS-485.
- **Configuration:** Half-Duplex, with RTS signal.
- **Galvanic Insulation:** 1.500V/1min.
- **Max. cable length:** 1000 m (total).

ↄ **Receiver:**
Maximum common mode voltage: $-7V \leq Vcm \leq +12V$;
Voltage threshold of differential input: min. $-0,2V$
                                                    Max.$+0,2V$;
Hysteresis: approx. 70mV;
Input impedance: $\geq 12K\Omega$ (resistor S1 Off);
Leakage current without supply: $\leq 20\mu A$;

ↄ **Transmitter:**
Differential voltage: without load: $\leq 5V$
                              With load   : $27\,\Omega$: $\leq 1,5V$;
Common mode voltage: with load 27Ω: $\leq 3V$;
Differential voltage variation between complementary status: $\leq 0,2V$;

ↄ **Operation temperature:** $\leq 60°C$.

6.1.2 EIA/RS-485 WEG Connection

ↄ It must be connected directly point to point or in network with each parallel branch.
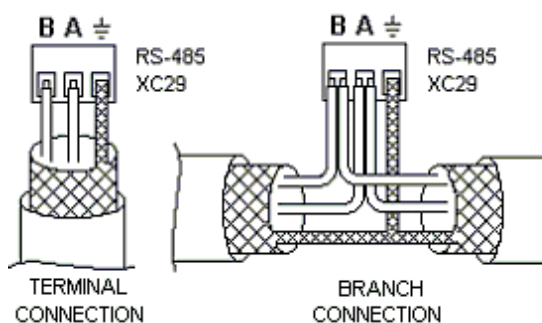
6.1.3 EIA/RS-485 WEG Cares

ↄ Factors such as unbalance and mutual cable capacitance tend to reduce the network noise immunity.

ↄ In the practice, the cable cross section must be larger or to 26AWG (0,14mm²), shielded twisted pair cable.

ↄ The cable shield must be grounded at all connections of the network through the EIA/RS-485 connectors.

6 COMMUNICATION INTERFACES

þ All network equipment must be grounded.

þ For the serial interface cables use separate conduits .

þ Don't forget to install terminating resistors at the ends of the network at disconnect the resistor from the internal network equipment.

þ Relays, contactors, solenoid valves, coils of electromechanical brakes installed near the MFW-01 may generate interferences in the control circuit. To eliminate this interference, connect RC suppressor filter in parallel with the coils of these devices, when AC supply is used and free-wheel diode, when DC supply is used.

6.1.4 EIA/RS-485 WEG Cable Definition

þ The EIA/RS-485 does not specify a standard cable, but it recommends some cares to be take during it selection.

þ To reduce the cable reflection at maximum, connect a resistor (Rt) at each cable end. This resistor must have the same impedance as the characteristic cable impedance.

þ These resistors are already available on MIW-02 by setting the S1 switch to ON.

þ The max. ohmic resistance of the cable is determined by the following equation:

$$R_{LOOP} \quad \frac{Rt\,(1{,}5 - Vo)}{Vo}$$

where:
Vo = voltage at the cable end (V); max. 1,5V;
Rt = terminating resistor (ohms);
R_{LOOP} = cable resistance (ohms)

þ The noise level variation (ΔVR) is defined by:

$$\Delta VR = VO - 0{,}2$$

þ Thus, the larger the cable cross-section, the lower will be the resistance and the larger will be the noise level variation.

þ Cable examples:

The following cables have been calculated for $\Delta VR = 1{,}0V$ and $Rt = 120\ \Omega$.

Data:
Manufacturer: KMP
Series: AFS
Type: 1 balanced pair of cables with aluminized polyester tape shield + tinned stranded copper wires.

Length	Section	Manufacturer Code	Ω/km (R_{loop})	Zo (f=100kHz)
$\leq$ 120 metros	26 AWG (0.14mm^2)	415001	250	100Ω
$\leq$ 200 metros	24 AWG (0.23mm^2)	415014	146	89Ω
$\leq$ 300 metros	22 AWG (0.36mm^2)	415027	100	84Ω
$\leq$ 500 metros	20 AWG (0.56mm^2)	415040	58	86Ω
$\leq$ 800 metros	18 AWG (0.94mm^2)	415053	36	79Ω
$\leq$ 1000 metros	16 AWG (1.35mm^2)	415066	28	77Ω

Note:

This manufacturer has been adopted only as suggestion.

6.1.5 XC4 Connector Description

þ MFW-01 connector for the EIA/RS-485 XC4.

þ Max. Torque of connector nut: 0,3Nm.

TERMINAL	SYMBOL	DESCRIPTION
1	B	Data transmission and reception
2	A	
3	Ground	The cable shield must be ground. The MFW-01 frame must be ground to the fastening bolts.

6.2 EIA/RS-232 WEG INTERFACE

For point to point connection with equipments through a standard EIA/RS-232 line. It works with both protocols.

6 COMMUNICATION INTERFACES
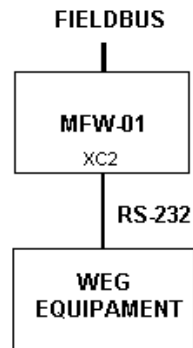
þ In this case we will have the connection of an MFW-01 (master) to WEG equipment (point to point) and the data can be communicated only with one WEG equipment. As there are only few data present, this will accelerate the updating of the data that that are available on the network.

þ The logical levels follow EIA/RS-232, that determines the use of non balanced signals.

þ For the EIA/RS-232 a communication cable is used .

6.2.1 EIA/RS-232 WEG Electrical Characteristics

þ **EIA/RS-232:**
- **Standard:** EIA/RS-232.
- **Transmission speed:** 9.600bps.
- **Max. cable length:** 10 m.

þ **Receiver:**
Max. input voltage: $\pm$ 30V;
Input resistance: > 3KΩ
Level 1 (MARK): < -3V;
Level 0 (SPACE): > +3V.

þ **Transmitter:**
Current Limit: ~ 10mA;
Output voltage level 1: < -7V (RL = 3K);
Output voltage level 0: > +7V (RL = 3K).

6.2.2 EIA/RS-232 WEG Connection

þ It must be connected point to point directly.

XC2 Connector
MFW-01

XC...Connector
of Weg
equipament
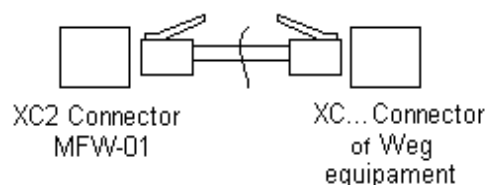
6.2.3 EIA/RS-232 WEG Cares

Þ Please note that this interface is not isolated against the internal equipment electronics to which it is connected.

Þ Please lay the EIA/RS-232 wiring separately from power wiring by maintaining a min. distance of 10 cm between them.

Þ It is recommended to install the MFW-01 as close as possible to the EIA/RS-232 serial interface of WEG equipment.

NOTE!

Þ Please check in the Hardware Manual of the respective WEG equipment the needed requirements for the EIA/RS-232 Serial communication.

6.2.4 EIA/RS-232 WEG Cable Definition

Þ The required cable is the standard cable for the serial WEG communication, equipment x serial HMI (Human-Machine Interface).

Length	WEG Item
RS-232 WEG Serial Cable with 0.17m	0307.4790
RS-232 WEG Serial Cable with 0.23m	0307.4803
RS-232 WEG Serial Cable with 0.32m	0307.4811
RS-232 WEG Serial Cable with 1m	0307.4820
RS-232 WEG Serial Cable with 2m	0307.4838
RS-232 WEG Serial Cable with 3m	0307.4846

6.2.5 EIA/RS-232 WEG XC2 Connector Description

Þ MFW-01 connector for the EIA/RS-232 XC2.

TERMINAL	SYMBOL	DESCRIPTION
1	Rx	Data reception
2	GND	0V
3	Tx	Data transmission
4	GND	0V
5	nc	Not connected
6	nc	Not connected

Þ WEG equipment connector for EIA/RS-232 XC.....

6 COMMUNICATION INTERFACES

TERMINAL	SYMBOL	DESCRIPTION
1	+5V	+5V ±5% (output)
2	RTS	Request To Send
3	GND	0V
4	Rx	Data reception
5	GND	0V
6	Tx	Data transmission

6.3 EIA/RS-232 PC INTERFACE

This interface It is used only for the transfer of PC programs.
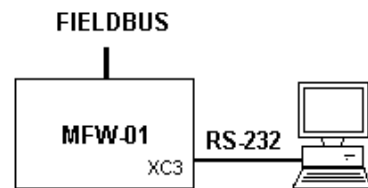
þ In this case we will have a point to point connection of the MFW-01 to one PC for the program transfer realized in the MFW.exe Software .

þ The logical levels follow the EIA Standard EIA/RS-232C and the protocol is the WEG one for the program transmission of this product.

þ The program is transferred simultaneously, and if a checksum error occurs at the end of the data transfer, an error will be indicated in the MFW.exe software .

6.3.1 EIA/RS-232 PC Electrical Characteristics

þ Same as Item 6.2.1.

6.3.2 EIA/RS-232 PC Connection

þ It must be connected directly to serial PC Interface.
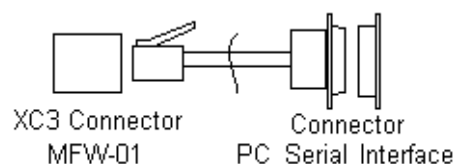
6.3.3 EIA/RS-232 PC Cares

þ Please check if there are grounding differences between the MFW-01 and the PC grounding in order to avoid that one of the devices may burn.

6.3.4 EIA/RS-232 PC Cable Definition

þ The required cable is the standard cable for WEG serial communication, equipment x PC.

Length	WEG Item
RS-232 PC serial cable with 3m	0307.5460

Note:

This cable is supplied with the MFW-01.

6.3.5 XC3 Connector Description

þ MFW-01 connector of the EIA/RS-232 XC3 for the PC.

TERMINAL	SYMBOL	DESCRIPTION
1	nc	Not connected
2	nc	Not connected
3	nc	Not connected
4	Rx	Data reception
5	GND	0V
6	Tx	Data transmission

þ Serial Connector of the PC (DB9).

TERMINAL	SYMBOL	DESCRIPTION
1		Not connected
2	Rx	Data reception
3	Tx	Data transmission
4		Not connected
5	GND	0V
6		Not connected
7		Not connected
8		Not connected
9		Not connected

7 DIGITAL INPUS AND OUTPUTS

7.1 DIGITAL INPUTS

þ MFW-01 is fitted with 6 digital inputs and 4 digital outputs.

þ These inputs and outputs are driven directly at the first writing and reading addresses of the 0000H Fieldbus.

þ MFW-01 is fitted with 6 optocoupled inputs that are available at terminals 1 to 15 of the XC5 connector

þ They are activated with high level +24Vcc.

þ All points have a common reference available at terminal 15 of connector XC5.

þ If the application is not fitted with a +24Vcc source, MFW-01 has an auxiliary source to activate de digital inputs.

NOTE!

The auxiliary source serves to supply the digital inputs.

7.1.1 Digital Inputs Electrical Characteristics

þ Isolation between the inputs and the electronics: 250Vac.

þ There is no isolation between the input points.

þ Logical level, max. and min. current and voltage:

15mA 2..15mA	High level = 1	30V 15V
	Uncertainty Zone	
0,5..15mA 0mA	Low level = 0	5V 0V

þ +24Vcc aux. source: +24Vcc ±5% 250mA max.

þ Hardware filter with time constant around 1 ms.

7.2 DIGITAL OUTPUTS

þ MFW-01 has 4 digital relay outputs, available at the terminals 9 to 16 of the connector XC5.

þ All output points are isolated and do not have common points.

7.2.1 Digital Outputs Electrical Characteristics

þ Isolation between the outputs and the electronics: 250Vac.

þ Isolation between the output points: 250Vac.

þ Max. relay voltage: 250Vac.

þ Max. current: 125Vac 0,5A, 250Vac 0,25A (62,5VA), 30Vcc 2A (60W).

þ Is not fitted with internal fuse.

7.3 XC5 CONNECTOR DESCRIPTION

þ Connector of the digital inputs and outputs.

þ Max tightening torque of the connector nut: 0,3Nm.

þ Connector duty data: 250Vac 2A.

þ Cable sections: 0,5...1,5mm².

| TERMINAL	SYMBOL	DESCRIPTION
1	DI 1	Digital input 1 (+24Vcc)
2	DI 2	Digital input 2 (+24Vcc)
3	DI 3	Digital input 3 (+24Vcc)
4	DI 4	Digital input 4 (+24Vcc)
5	DI 5	Digital input 5 (+24Vcc)
6	DI 6	Digital input 6 (+24Vcc)
7	+24Vcc	Aux. Source of the digital inputs
8	0V	Common of the digital inputs
9	DO 1	Digital output 1
10		(NO contact)
11	DO 2	Digital output 2
12		(NO contact)
13	DO 3	Digital output 3
14		(NO contact)
15	DO 4	Digital output 4
16		(NO contact)

NOTE!

All output points will be cleared while happening a fieldbus communication error on the DeviceNet and Profibus-DP modules.
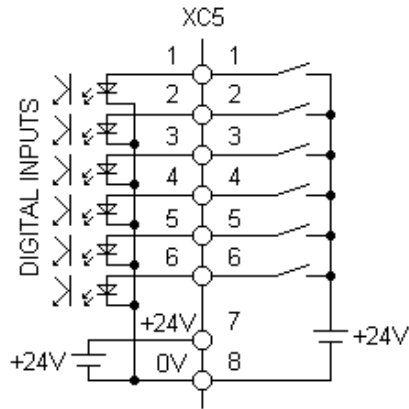
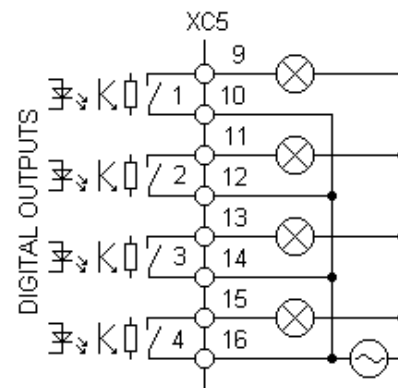# 7 DIGITAL INPUS AND OUTPUTS

7.4 XC5 CONNECTION DIAGRAM
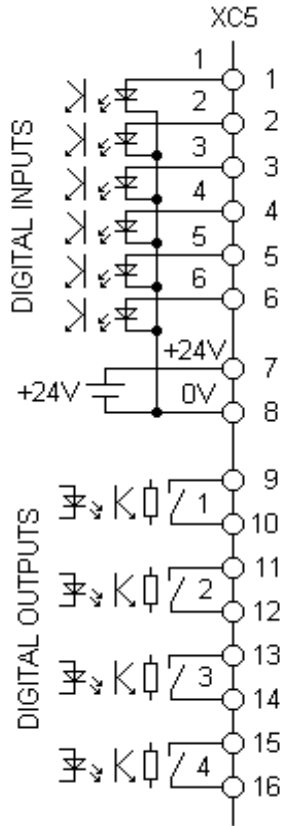
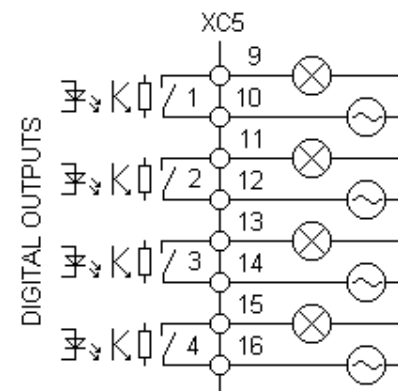þ Digital inputs using the aux. internal source:
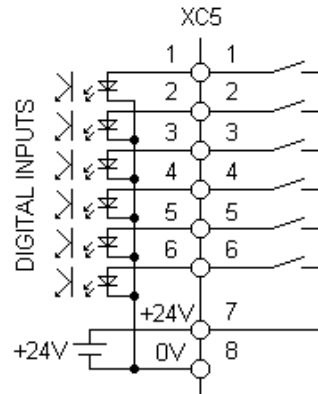
þ Digital inputs using a aux. external source:

þ Digital outputs with common supply source


þ Digital outputs with isolated supply sources:

8.1 MFW.exe v2.00

MFW-01 Programming Software for MS-Windows.

þ Simple and easy to operate;

þ It allows the user to choose which variable of a determined equipment will be available in the Fieldbus memory;

þ It allows the user to choose which protocol will be used by the equipments in the subnet.

8 PROGRAMMING SOFTWARE

8.2 DETAILED DESCRIPTION OF THE MFW.exe v2.00
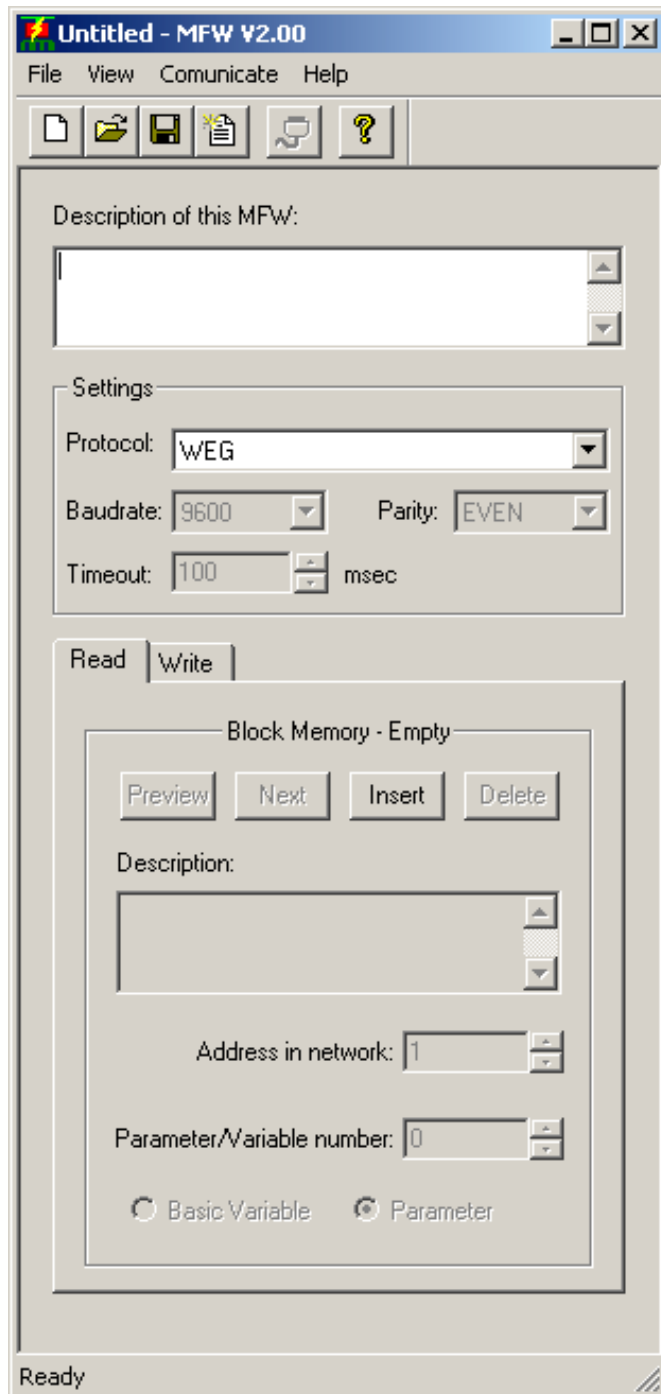
þ Manipulation of the files:

FILE:
New, open, save, save as, create text file (arq.txt) and exit;

EDIT:
Undo, cut, copy and past.

HELP:
About MFW.exe v2.00.

þ Manipulation of variables:

Description of this MFW:
Area reserved for text to describe the function of this MFW- 01 in the Fieldbus network.

Settings:
Protocol: protocol to be used in the subnet, WEG or Modbus-RTU.
Baudrate: standard baud rate in the subnet; 9600bps for WEG protocol and at most in 19200 for Modbus-RTU.
Parity: parity type; always even for WEG protocol and configurable by the user for Modbus-RTU
Timeout: time to wait between sucessive telegrams if any error ocurrs; 100ms for WEG protocol and configurable from 50ms to 1000ms with step of 10ms for Modbus-RTU.

Read / Write:
Read: defines the variables in the input area to be read by the master.
Write: defines the variables in the input area to be changed by the master.

Block Memory:
Defines the address of the variable in the input or output area of the Fieldbus (from 1 to 48 address for each area).

Preview: previous display;
Next: Next display;
Insert: Inserts one variable more;
Delete: Deletes the current variable.

Note:
- The software does not allow that the next block can be programmed, if the previous one is not programmed correctly.
- Always when a memory block is deleted, the next variable is stored in this position.

Description:
Area reserved for text to describe the function of this variable in the MFW-01 or to describe the function of any equipment in the subnet.

Address in network:
It defines the addressing of the driver in the subnet to which the variable refers. (1 to 30 for WEG and 1 to 247 for Modbus-RTU);

Number of variable:
Defines the address in the driver (0 to 999):
If it is a parameter address (P00 = 0);
If it is a logical control (V00 = 0).

Basic Variable / Parameter:
Basic Variable: it defines if this is a logical control variable (Vxx);
Parameter: defines if it is a parameter variable (Pxx).

Communicate:
Send All: it sends the programming to the MFW-01.
Serial Port Number: it selects the serial pot of the PC to communicate with the MFW-01.

8.3 TECHNICAL DATA OF THE MFW.exe v2.00

þ Programming, configuring and programs transferring are realized in a simple window;

þ 100% compatible wih configuration files from previous version (v1.00).

8.4 MINIMUM REQUIRED CONDITIONS

þ Required hardware:

- PC Personal Computer (or other compatible) with: 16MB RAM, hard disk with at least 10MB of free space, VGA monitor or better and EIA/RS-232 serial port compatible.

þ Required software (supported operating systems):

- Windows 95, 98, NT, Me, 2000 and XP.

8 PROGRAMMING SOFTWARE

8.5 MFW.exe v2.00 Installation

Insert the floppy disk in drive A: and double click setup.exe.

9 EXAMPLES

This section show three cases, two application examples of MFW-01 in a DeviceNet network and one in a Profibus-DP network. The first one (item 9.1), one MFW-01 controls one CFW-08 inverter via EIA/RS-232 using Modbus-RTU protocol. In the second example (item 9.2), one MFW-01 controls one CFW-08 and one SSW-05; these three devices form which we call a subnet. They are connected by EIA/RS-485 standard using WEG protocol. In the third example (item 9.3), physical structure is the same that found in first example. The exception is the protocolo used, Profibus-DP instead of Modbus-RTU. MIW-02 usage is shown too when necessary.

9.1 EXAMPLE 1

Master
(CLP or PC)

ß DeviceNet Protocol à

MFW-01

RS-232

DeviceNet Slave
Node

ß Modbus-RTU Protocol à
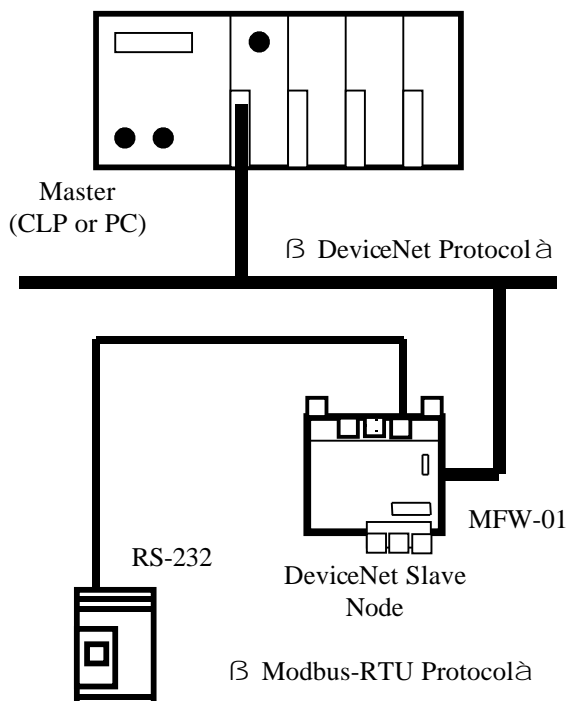
þ Which Fieldbus does the master use?
- **DeviceNet**, then **MFW-01/DN**.

þ How many and which equipment the master must control?
- Only one CFW-08.

þ Which protocol will be used in the subnet ?
- Modbus-RTU with 19200bps of baud rate, even parity and delay of 50ms between telegrams.

þ What varables will be controlled, what is the refresh rate required ?
- CFW-08: it will be read logical status, frequency and motor current; and it´ll be write logical control and referency of frequency given by serial. Variable´s refresh time are not taken into account because there´s a small number of it. Even with some delay, this will not have negative influency in our process.

þ Are equipments fitted with EIA/RS-232 serial interface?
- Yes, and this is default in most of WEG devices. As we are realising point-to-point connetion, we just need to connect one side of RS-232 serial cable (WEG standard for this

þ purpouse) to XC2 conector of MFW-01 and another side to XC8 connector of CFW-08. Details about these cables are given in sections 6.2.4 e 6.2.5.

þ Is the use of remote I/O interface of the MFW-01 required?
  * Yes. Reading on two push buttons and indication on two displays.

9.1.1 Variable Definitions

þ According to the manual of CFW-08:
  * CFW-08**:** read VB02 indicating logical status, P005 and P003 motor frequency and current, respectively; write VB03 logical control and VB04 frequency reference given by serial interface.

9.1.2 Equipment Addresses

þ MFW-01 must be assigned a valid identifier in the Fieldbus network;

þ In the subnet, each equipment should have an address which is independent of the higher fieldbus :

  * CFW-08: Set P308 to 1;
         P220 to 1;
         P222 to 5;
         P230 to 2;
         P231 to 2.

9.1.3 Programming with MFW.exe v2.00

þ You must program all variables, by separating them between reading and writing variables and observing the correct sequence.

9 APPLICATION EXAMPLES
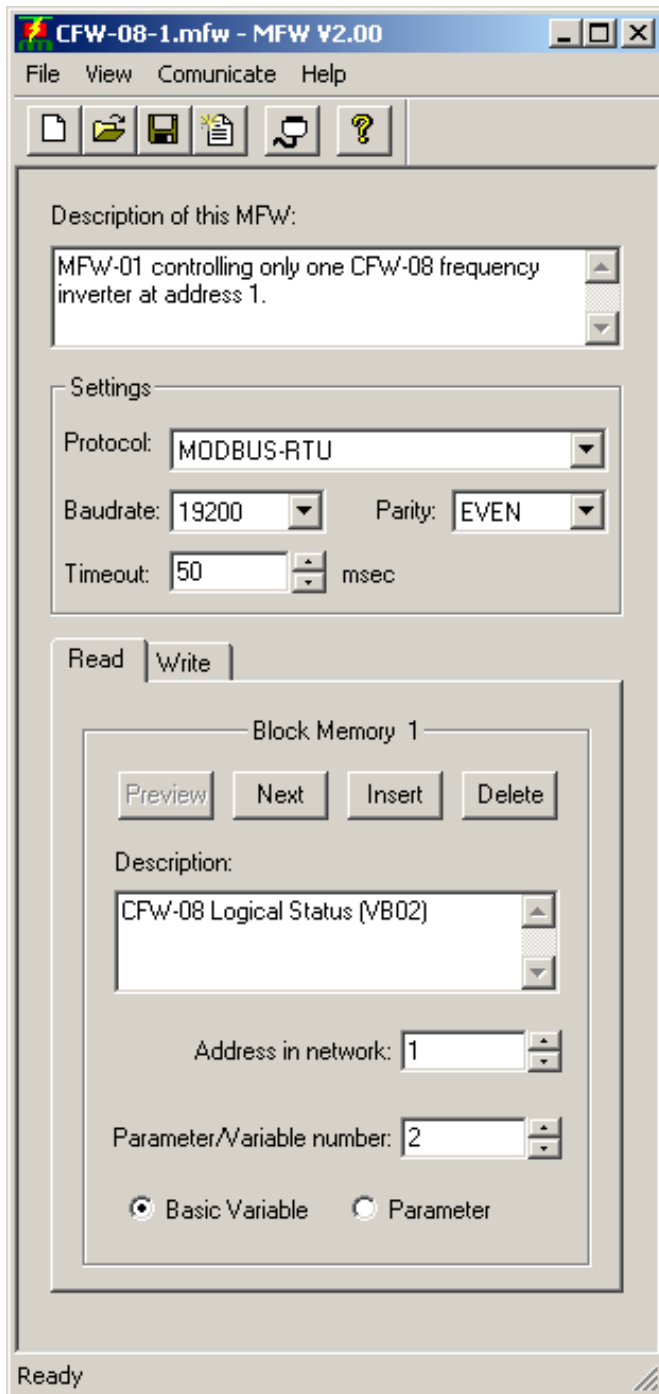
Read:
CFW-08 VB02 address 1 basic variable
CFW-08 P005 address 1 parameter
CFW-08 P003 address 1 parameter

Write:
CFW-08 V03 address 1 basic variable
CFW-08 V04 address 1 basic variable

9.1.4 Program Transferring

þ With PC connected to MFW-01, and this set to PROG, select menu item Communicate → Send All.

9.1.5 Correct Program Certification

þ To check the correct variable programming MFW.exe v2.00 generates a file.txt through the menu item File → Create Text File.

```
Weg Industrias S.A. - Automacao
MFW Application
File: CFW-08.txt

Description of this MFW: MFW-01 controlling only one CFW-08 frequency inverter at
address 1.

Settings:
    Protocol: MODBUS-RTU
    Baudrate: 19200 bps
    Parity: EVEN
    Timeout: 50 msec

*************************************************

Read Block Memory 01
--------------------
Description of this Block Memory: CFW-08 Logical Status (VB02)
Address in Network: 1
Basic Variable: VB2

Read Block Memory 02
--------------------
Description of this Block Memory: CFW-08 Motor Frequency (P005)
Address in Network: 1
Parameter: P5

Read Block Memory 03
--------------------
Description of this Block Memory: CFW-08 Motor Currenty (P003)
Address in Network: 1
Parameter: P3

*************************************************

Write Block Memory 01
--------------------
Description of this Block Memory: CFW-08 Logical Control (VB03)
Address in Network: 1
Basic Variable: VB3

Write Block Memory 02
--------------------
Description of this Block Memory: CFW-08 Motor Speed Reference (VB04)
Address in Network: 1
Basic Variable: VB4
```

9.1.6 Table at DPRAM

In this example with DeviceNet, the variable address table at DPRAM for communication with the master of the high network will be as follows:

9 APPLICATION EXAMPLES

Addressing of the DPRAM variables for the example above						
Inputs				Outputs		
Addr.		Definitions		Addr.		Definitions
0		Status of the digital inputs		0		Status of the digital outputs
1		General Status		1		Control
1st input block				1st output block		
2		Status of the 1st input block				
3		Status of the 1st output block				
4	L	VB02 CFW-08		2	L	VB03 CFW-08
5	H			3	H	
6	L	P005 CFW-08		4	L	VB04 CFW-08
7	H			5	H	
8	L	P003 CFW-08				
9	H					

Addresses:

Inputs: the master will read.

- 0 status of the two push button, activated or not;
- 1 general status of MFW-01, in communication, etc.;
- 2 status of the 3 input variables, if error occurred;
- 3 status of the 3 output variables, if error occurred;
- 4 content of byte low of VB02, according to manual;
- 5 content of byte high of VB02, according to manual;
- 6 content of byte low of P005
- 7 content of byte high of P005
- 8 content of byte low of P003
- 9 content of byte high of P003

Outputs: the master will write.

- 0 the value of the two flags;
- 1 controls of MFW-01, enables readings, etc.;
- 2 value for byte low VB03, according to manual;
- 3 value for byte high VB03, according to manual;

- 4 content of byte low of VB04;
- 5 content of byte high VB04.

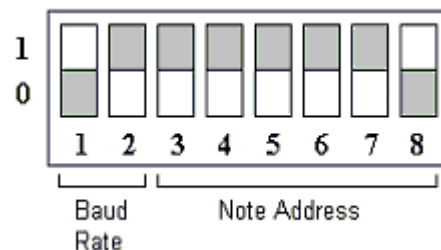**PS:**
This table is indicated in bytes:

1 byte = 8 bits.
1 word = 2 bytes = 16 bits

9.1.7 DeviceNet Network Definition

þ Which is the address of MFW-01 and the baud rate on the DeviceNet Network?
- Address 3 and 500kbit/s.

MFW-01 dip switch:

þ Configuration on the DeviceNet Data Manager:
- **Polled Connection** according to item 9.1.7
- Input Size **10** bytes
- Output Size **6** bytes

Note:
A total of 5 reading words from the address 0000h on and a total of 3 writing words from the address 0000h on.

þ Before start scanning read/write variables it´s necessary to configure the Fieldbus network. Thus, one use dedicated software given by manufacturer of the equipment. Each one has its own software to do it and, for this reason, there is some differences between them. However, some actions are common to all of them:

- Adding MFW-01 to the scanlist of scanner DeviceNet;
- Mapping monitored variables in the

CLP memory;

- Transferring all these information back to the scanner.

NOTE!

Remember that the master controls all data transmission and reception by means of certain control word in you specific scanner module.

9.1.8 Assembly Sequence Summary

1. Make physical assembling of the network. Connect though specific cables according to the protocol used MFW-01 to the Fieldbus (slave).

2. Assign na valid address to MFW-01. Remember that each equipement in the Fieldbus must be only one within the same domain.

3. Adjust other options like baud rate and parity type when necessary.

4. Connect MFW-01 to the equipments that will belong to the subnet. This connection can be made using EIA/RS-232 (if point-to-point link is desired) or EIA/RS-485 (in case of multi-pointi). The right way to do it is described in details in chapter 6.

5. Assing an only one and valid address to the equipments controlled by MFW-01. These one are independent of Fieldbus addresses. It can exist, for instance, same addresses in different domains. Domains means networks. There´s no problem a device have identifier 1 in the subnet and another have the same addresss in the Fieldbus network. It´s different domains, different networks.

6. When all connections were made, it´s time to do logical configurations, like to choose what parameters/basic variables will be read/write.

7. With MFW.exe v2.00 configuration software, type what parameters/basic variables will be controlled and, after that, transfer all this

programming to the equipment. This is the read/write cycle. Time to process all inputs and all outputs is called scan time.

8. The next step is Fieldbus network configuration. This procedure can vary according to the chosen protocol and equipments used, like PLCs and software to do it. Despite of this, some actions are common, like recognition of MFW-01 using Fieldbus configuration software and the programming of exchanged variables between scanner module and MFW-01.

9. Now, MFW-01 is ready to start his read/write cycle of parameters/basic variables within subnet.
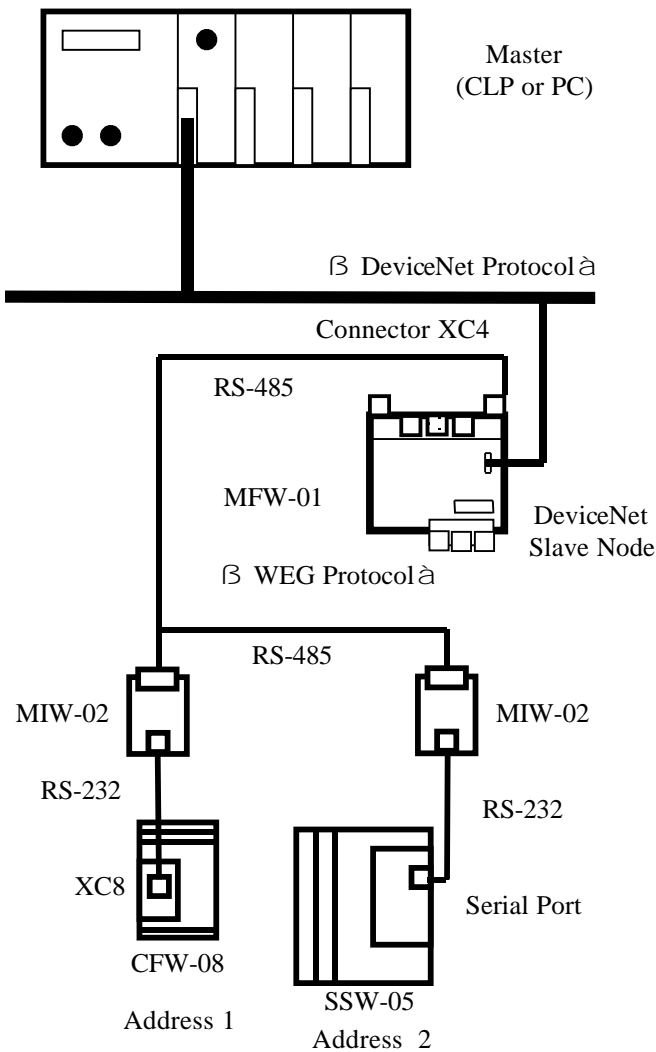
NOTE!

þ The quantity of simultaneos managed devices is a function of exchanged words, Greater number of words, lower number of controlled devices, until the limit of 48 words.

þ The refresh rate is directly proportional to the number of monitored variables. Greater this number, lower time to update it. This point should be evaluated during the project of the network. Fast process may require values updated always as possibles, so it´s a good ideia to use a MFW-01 configured with small words to guarantee this requirement.

9 APPLICATION EXAMPLES

9.2 EXAMPLE 2

Master
(CLP or PC)

ß DeviceNet Protocol à

Connector XC4

RS-485

MFW-01

DeviceNet
Slave Node

ß WEG Protocol à

RS-485

MIW-02

MIW-02

RS-232

RS-232

XC8

Serial Port

CFW-08
Address 1

SSW-05
Address 2

þ Which Fieldbus does the master use?
- **DeviceNet**, então **MFW-01/DN**.

þ How many and which equipment the Master must control?
- Two, one CFW-08 inverter and one SSW - 05 soft-starter.

þ Which protocol will be used in the subnet ?
- WEG protocol with 9600bps of baud rate, even parity and delay of 100ms between telegrams.

þ What variables will be controlled, what is the refresh rate required ?

- CFW-08: it will be read logical status, frequency and motor current; and it´ll be write logical control and referency of frequency given by serial. Variable´s refresh time are not taken into account because there´s a small number of it. Even with some delay, this will not have negative influency in our process.

- SSW-05: it will be read logical status na motor current; and it´ll be write logical control.

þ Are equipments fitted with EIA/RS-232 serial interface?
- Yes, and this is default in most of WEG devices. In this case, as we are connecting two devices, EIA/RS-232 can not be used. For multi-point connections, EIA/RS-485 will be the data communication standard chosen. But, as these equipments doesn´t have native interface, it will be mandatory to use na signal converter, which is called MIW-02. This device allows any equipment without EIA/RS-485 to belong to networks that use this protocol. More details about this cable are given in items 6.2.4 e 6.2.5.

þ To realise that, just connect one side of the serial cable to the equipment (XC8 in CFW-

08) and another side to XC1 in MIW-02.

þ EIA/RS-485 standard doesn´t specify one kind of cable, but suggests some cares in choosing one. Details about this standard are present in sections 6.1.2, 6.1.3 e 6.1.4.

þ EIA/RS-485 are made in XC29 connection of MIW-02, and XC4 of MFW-01. It should be noted the polarity of wires. Details about that are given in section 6.1.5.

þ Is it necessary to use MFW-01 mini-remota ?

- No, we´ll not use mini-remota in this network.

9.2.1 Variable Definitions

þ According to CFW-08 and SSW-05 manual:

- CFW-08**:** reading: VB02 - indicating logical status; P005 and P003 - frequency and motor current, respectively; writing: VB03 - indicanting logical control and VB04 - indicating frequency referency given by serial interface.
- SSW-05**:** reading: VB01 – indicating logical status and P003 – motor current; writing: VB03 - selection of logical control.

9.2.2 Equipment Addresses

þ It must be assigned a valid identifier to MFW-01 in the Fieldbus network;

þ In the subnet, each equipment should have an address which is independent of the higher fieldbus :

- CFW-08: Set P308 to 1.
- SSW-05: Set P308 to 2.

9.2.3 Programming with MFW.exe v2.00

þ You must program all variables, by separating them between reading and writing variables and observing the correct sequence.

9 APPLICATION EXAMPLES
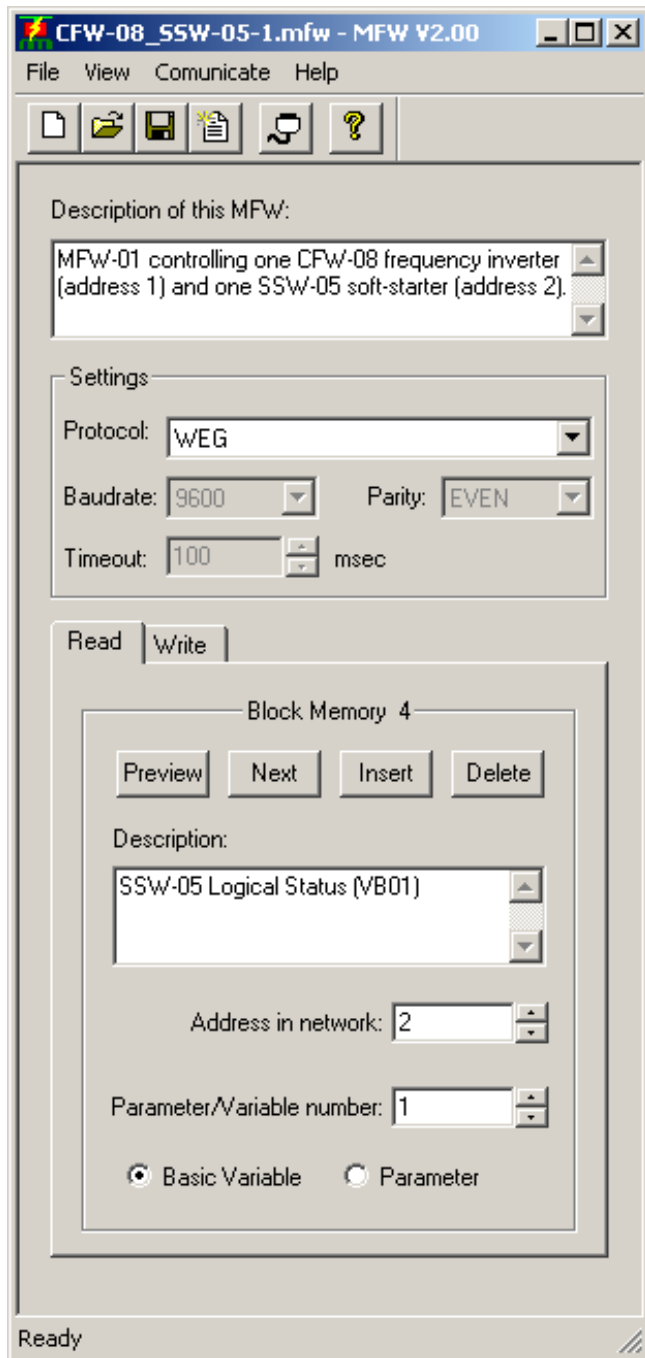
Read:
CFW-08 VB02 address 1 basic variable
CFW-08 P005 address 1 parameter
CFW-08 P003 address 1 parameter
SSW-06 VB01 address 2 basic variable
SSW-06 P003 address 2 parameter

Write:
CFW-08 VB03 address 1 basic variable
CFW-08 VB04 address 1 basic variable
SSW-06 VB03 address 2 basic variable

CFW-08_SSW-05-1.mfw - MFW V2.00

File   View   Comunicate   Help

Description of this MFW:

MFW-01 controlling one CFW-08 frequency inverter (address 1) and one SSW-05 soft-starter (address 2).

Settings

Protocol: WEG

Baudrate: 9600   Parity: EVEN

Timeout: 100 msec

Read | Write

Block Memory 4

Preview   Next   Insert   Delete

Description:

SSW-05 Logical Status (VB01)

Address in network: 2

Parameter/Variable number: 1

⦿ Basic Variable   ○ Parameter

Ready

9.2.4 Program Transferring
þ See item 9.1.4.

9.2.5 Correct Program Certification
þ See item 9.1.5.

```
Weg Industrias S.A. - Automacao
MFW Application
File: CFW-08_SSW-05.txt

Description of this MFW: MFW-01 controlling one CFW-08 frequency inverter (address
1) and one SSW-05 soft-starter (address 2).

Settings:
    Protocol: WEG
    Baudrate: 9600 bps
    Parity: EVEN
    Timeout: 100 msec

*************************************************

Read Block Memory 01
--------------------
Description of this Block Memory: CFW-08 Logical Status (VB02)
Address in Network: 1
Basic Variable: VB2

Read Block Memory 02
--------------------
Description of this Block Memory: CFW-08 Motor Frequency (P005)
Address in Network: 1
Parameter: P5

Read Block Memory 03
--------------------
Description of this Block Memory: CFW-08 Motor Current (P003)
Address in Network: 1
Parameter: P3

Read Block Memory 04
--------------------
Description of this Block Memory: SSW-05 Logical Status (VB01)
Address in Network: 2
Basic Variable: VB1

Read Block Memory 05
--------------------
Description of this Block Memory: SSW-05 Motor Current (P003)
Address in Network: 2
Parameter: P3

*************************************************

Write Block Memory 01
--------------------
Description of this Block Memory: CFW-08 Logical Control (VB03)
Address in Network: 1
Basic Variable: VB3

Write Block Memory 02
--------------------
Description of this Block Memory: CFW-08 Motor Speed Reference (VB04)
Address in Network: 1
Basic Variable: VB4

Write Block Memory 03
```

9 APPLICATION EXAMPLES

```
----------------------
Description of this Block Memory: SSW-05 Logical Control (VB03)
Address in Network: 2
Basic Variable: VB3
```

9.2.6 Table at DPRAM

▷ In this example with DeviceNet, the variable address table at DPRAM for communication with the master of the high network will be as follows:

Addressing of the DPRAM variables for the example above							
Inputs				Outputs			
Addr.		Definitions		Addr.		Definitions	
0		Status from Digital Inputs		0		Status to Digital Outputs	
1		General Status		1		Control	
1st input block				1st output block			
2		Status of the 1st input block					
3		Status of the 1st output block					
4	L	VB02 CFW-08		2	L	VB03 CFW-08	
5	H			3	H		
6	L	P005 CFW-08		4	L	VB04 CFW-08	
7	H			5	H		
18	L	P003 CFW-08		16	L	VB03 SSW-05	
19	H			17	H		
22	L	VB01 SSW-05					
23	H						
24	L	P003 SSW-05					
25	H						
13	H						

9.2.7 Definitions on DeviceNet Network

þ Which is the address of MFW-01 and the baud rate on the DeviceNet Network?
  • Address 1 and 500kbps.

MFW-01 dip switch:
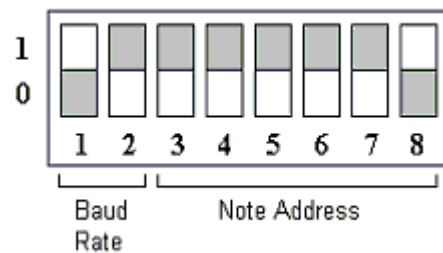
þ Configuration on the DeviceNet Data Manager:
  • **Polled Connection** according to item 9.1.7
  • Input Size **14** bytes
  • Output Size **8** bytes

Note:
A total of 7 reading words from the address 0000h on and a total of 4 writing words from the address 0000h on.

þ Before start scanning read/write variables it´s necessary to configure the Fieldbus network. Thus, one use dedicated software given by manufacturer of the equipment. Each one has its own software to do it and, for this reason, there is some differences between them. However, some actions are common to all of them:

  • Adding MFW-01 to the scanlist of scanner DeviceNet;
  • Mapping monitored variables in the CLP memory;
  • Transferring all these information back to the scanner.

NOTE!
Remember that the master controls all data transmission and reception by means of certain control word in you specific scanner module.

9 APPLICATION EXAMPLES

9.2.8 Assembly Sequence Summary

See item 9.1.8.

9.3 EXAMPLE 3

Master
(CLP or PC)

ß Profibus-DP Protocolà

MFW-01

RS-232

Profibus-DP Slave
Node
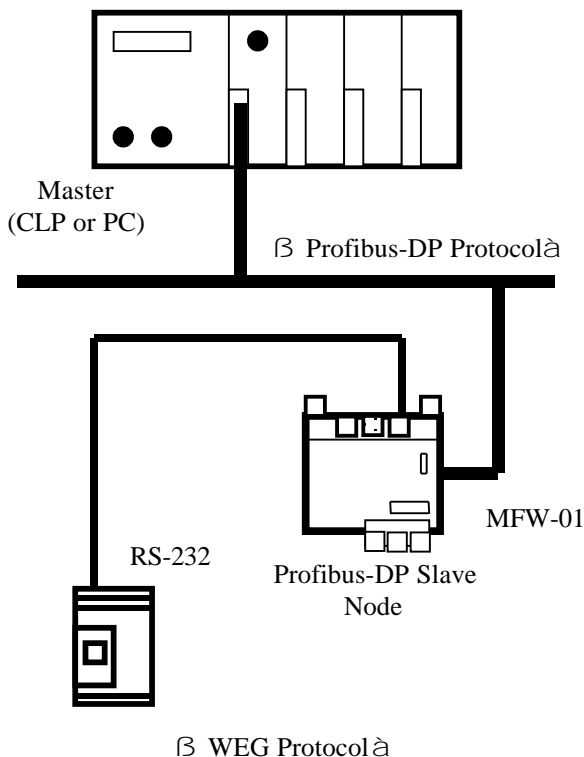
ß WEG Protocolà

þ Which Fieldbus does the master use?
- **Profibus-DP**, então **MFW-01/PD**.

þ How many and which equipment the master must control?
- Only one SSW-05.

þ Which protocol will be used in the subnet ?
- WEG protocol with 9600bps of baud rate, even parity and delay of 100ms between telegrams

þ What variables will be controlled, what is the refresh rate required ?
- CFW-08: it will be monitored logical status and motor current; and controlled logical control. In this case, as it important to have always updated values, we decided to monitor as few as possible parameters/basic variables.

þ Are equipments fitted with EIA/RS-232 serial interface?
- Yes, and this is the standard for most of WEG equipments. As we´re realizing point-to-point conection, it´s enough to use the right cable. Details about it are present in items 6.2.4 and 6.2.5.

þ Is it necessary to use MFW-01 mini-remota ?
- No, we´ll not use mini-remota in this network.

þ When protocol, equipments and variables are defined, almost the rest is equal to the examples presented before.

þ Every programming made in MFW-01 is independent of the protocol used. It doesn´t matter if this is DeviceNet or Profibus-DP.

þ Profibus-DP configuration is pretty different compared to DeviceNet. It´s necessary to consult specific documentation about the subject to successfully configure a network.

þ MFW-01 addressing in Profibus-DP network is made by two rotating switches, presets in the Anybus board. The left one represents tens while the right one represents units. Combining both we have the right identifier.

10 DEVICENET

10.1 INTRODUCTION TO DEVICENET

DeviceNet is used for industrial automation, normally for the control of valves, sensors and I/O units and other automation equipment. The DeviceNet communication link is based on a broadcast-oriented, communications protocol, the Controller Area Network (CAN). This protocol has I/O response and high reliability even for demanding applications, e.g., control of brakes.

DeviceNet has an user organization, the Open DeviceNet Vendor Association (ODVA) that assists members of matters concerning DeviceNet. HMS is a member of ODVA and also represented as a member of the DeviceNet System Architecture SIG.

For further information, please contact ODVA at site:
http://www.ODVA.org.

10.2 NETWORK OVERVIEW

The media for the Fieldbus is a shielded copper cable composed of one twisted pair and two cables for the external power supply. The baud rate can be changed between 125k, 250k and 500kbit/s, this can be done in three different ways. First is simply by the DIP-switch, second via the Fieldbus and third is autobaud rate setting.

Several different DeviceNet Scanners are available on the market, both for PLC-systems and PC computers.
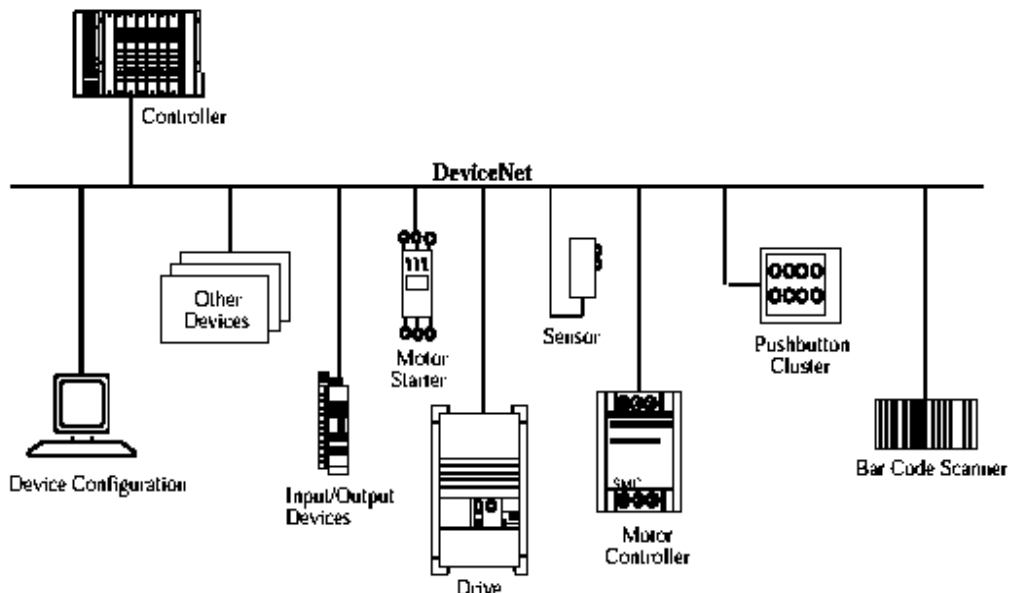
10.3 TECHNICAL FEATURES OF DEVICENET
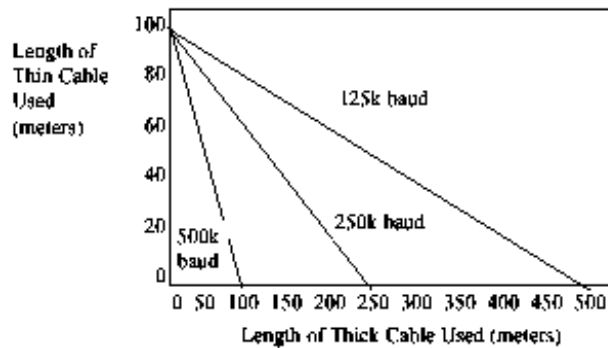
$$L_{thick} + 5 \times L_{thin} = 500 \qquad \text{at } 125\text{Kbaud}$$
$$L_{thick} + 2.5 \times L_{thin} = 250 \qquad \text{at } 250\text{Kbaud}$$
$$L_{thick} + L_{thin} = 100 \qquad \text{at } 500\text{Kbaud}$$

where L_{thick} is the length of thick cable and Lthin is the length of thin cable.

Technical Feature Summary of DeviceNet	
• DeviceNet specific cable (twisted pair); • Access to intelligence present in low-level devices -Master/Slave and Peer-to-Peer capabilities; • Trunkline-dropline configuration; • Support for up to 64 nodes; • Node removal without severing the network; • Simultaneous support for both network-powered (sensors) and self-powered (actuators) devices; • Use of sealed or open-style connectors; • Protection from wiring errors; • Selectable data rates of 125k baud, 250k baud, and 500k baud. max. Trunk distance 500 meters and Drop length 156 meters at 125k baud;	• Adjustable power configuration to meet individual application needs; • High current capability (up to 16 amps per supply); • Operation with off-the-shelf power supplies; • Power taps that allow the connection of several power supplies from multiple vendor that comply with DeviceNet standards; • Built-in overload protection; • Power available along the bus: both signal and power lines contained in the trunkline; • Provisions for the typical request/response oriented network communications; • Provisions for the efficient movement of I/O data; • Fragmentation for moving larger bodies of information; • Duplicate MAC ID detection.

10.4 CONFORMANCE TESTED

The AnyBus-S DeviceNet using the parallel interface has been tested by DVA's authorized Independent Test Lab and found to comply with ODVA Conformance Test Software Version A12.

The AnyBus-S DeviceNet using the serial interface will be tested in a near future.

10 DEVICENET

10.5 INSTALLATION & CONFIGURATION

10.5.1 Fieldbus Connectors

The table below shows the pin function of the Fieldbus connectors.

Plugging connector	Description	Cables colors
1	V-	Black
2	CAN_L	Blue
3	Shield	-
4	CAN_H	White
5	V+	Red

10.5.2 Baudrate

There are three different baudrates for DeviceNet; 125k, 250k, 500kbit/s. Choose one of them by setting the DIP-switch before configuring. Remark: Depending on if the switch is straight or right angled (90°), the ON indication is different.
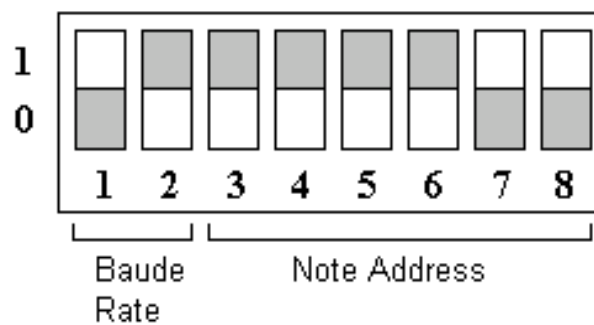
Baud rate bit/s	Dip 1-2
125k	00
250k	01
500k	10
Reserved	11

| Address	Dip 3-8
0	000000
1	000001
2	000010
3	000011
...	...
62	111110
63	111111

Remark:
In the example above, the configuration is:
• Baud rate of 500k (10) and Address 3 (000011).

10.6 INDICATIONS

The module is equipped with four LEDs mounted at the front and one LED on the board, used for debugging purposes. The front LEDs can be mounted in two ways, either top mounted or angle mounted. The functions of the LEDs are described in the table and figure below.
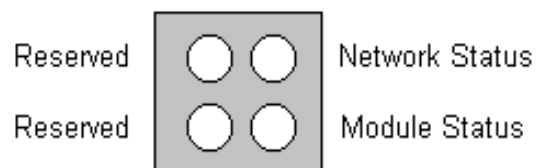
Two of the four LEDs at the front of the module are indicating network and module status, and the other two are reserved for future usage.

Module errors are indicated with the Module status LED and network status LED.

LEDs	Description
Module status, steady Off	No Power
Module status, steady red	Unrecoverable fault
Module status, steady green	Device Operational
Module status, flashing red	Minor fault
Network status, steady Off	Not Powered/Not on line
Network status, steady green	Link OK on line, Connected
Network status, steady red	Critical Link failure
Network status, flashing green	On line not connected
Network status, flashing red	Connection Time Out

10.7 TERMINATION

Termination of the Fieldbus requires a terminating resistor at each end of the Fieldbus. These resistors should have a value of 121 ohms.

10 DEVICENET

10.8 EDS FILE

Each device in a DeviceNet network is associated with an EDS.file, containing all necessary information about the device. The network configuration program during configuration of the network uses this file.

The latest version of EDS.file can either be downloaded from the webpage http://www.hms.se/fbfiles.htm or received by contacting HMS.

10.9 ADDITIONAL INFORMATION ABOUT DEVICENET

þ Connector of the MFW-01 for DeviceNet, max. tightening torque of the connector nuts: 0,3Nm.

þ The consumption of this network supply station is I=30mA in stand by and 100mA inrush.

þ Supported connections by AnyBus-S DeviceNet card:

- 1 Polled I/O

NOTE!

MFW-01 has been developed to operate in Polled I/O connection mode with optimized number of I/O.

Please find below an example using a DeviceNet network with a 1747-SDN Scanner Module and a 1770-KFD RS-232 Interface from Allen Bradley:

Configure the DeviceNet Manager, with the control Edit EDS Stub inside the editor Electronic Data Sheet Editor, the Polled connection to:

- Input Size xxx bytes .... equal to number of inputs.

- Output Size xxx bytes .... equal to number of outputs.

That means that you must configure exactly the same number of inputs in bytes that will be used as reading by the master and the same number of outputs in bytes that will be used as changes by the master. See item 5.2.

Consider all bytes up to the address of the last desired variable, the same that will be configured in the MFW.exe, in addition to the status and control words.

To optimize the system regarding the number of variables that are that circulating in the network, thus delaying the updating time, o MFW-01 has been developed to program itself automatically to the same number of I/O variables, that have been programmed in the MFW.exe in addition to the status and control words.

NOTE!

If the number of I/O is not compatible there will be no communication and no acknowledgement by MFW-01 in the DeviceNet network .

10.10 PROBLEMS AND SOLUTIONS FOR DEVICENET

þ Here are described some problems that can occur with the MFW-01 in DeviceNet networks.

Problems:	Solutions:
DeviceNet Data Manager does not identify the MFW-01	þ The file .EDS must correctly installed in the DeviceNet Data Manager; þ The number of I/O in Polled Mode must be compatible with the programmed one in MFW-01, see Item10.10 and 5.2; þ The MFW-01 address is unduly configured, see Item 10.6; þ MFW-01 Baud rate configured unduly, see Item 10.6.
DeviceNet without communication:	þ Check if the DeviceNet connections to MFW-01 are correct, see item 10.6.1; þ Check the DeviceNet network supply; þ Check the serial communication enabling in the DeviceNet network by the Master of the DeviceNet.

11 PROFIBUS-DP

11.1 INTRODUCTION TO PROFIBUS-DP

Profibus has an international user organization called Profibus International, PI, and local national organizations, PNO. HMS is represented as board member of Profibus Sweden since the start of the organization in 1992 and also as member of the Technical Committee at the American Profibus Trade Organization, PTO.

Technical questions regarding the Fieldbus should be addressed to your local Profibus User Group in the first instance.

Address list is available on the Profibus Internet site; www.profibus.com For general help on Profibus, contact

Profibus International on e-mail:
pi@profibus.com

Profibus-DP is normally used in industrial automation, to transfer fast data for motor controllers, MMI, I/O units and other industrial equipment.

11.2 NETWORK OVERVIEW

The media for the Fieldbus is a shielded copper cable consisting of a twisted pair. The baud rate for the bus is between 9.6kbaud to max. 12Mbaud. The Profibus-DP network can consist of 126 nodes and the total amount of data for Profibus-DP are 244 Byte out per module and 244 Byte in per module.

PLEASE NOTE: Node No. 126 is only used for commissioning purposes and should not be used to exchange user data.

The figure below gives an overview of a Profibus-DP network.
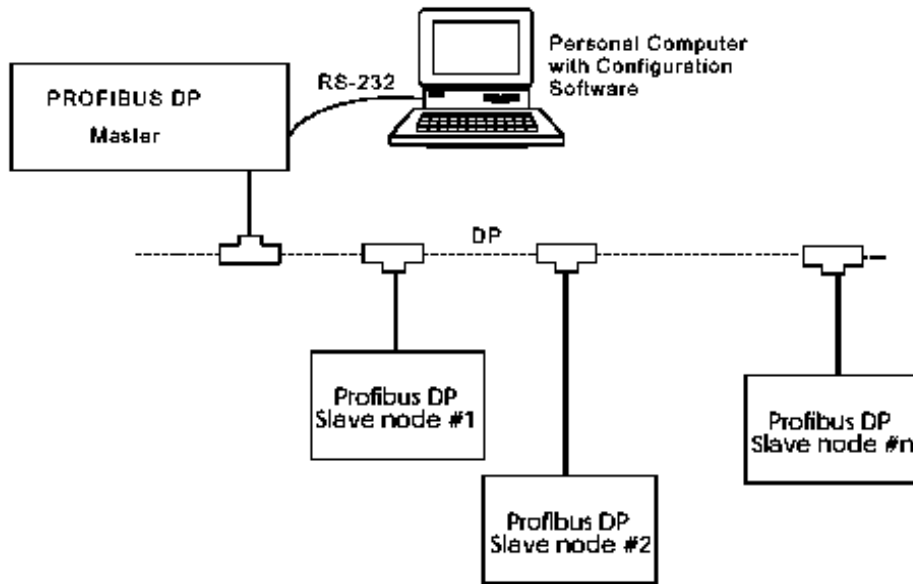
## 11.3 TECHNICAL FEATURES FOR PROFIBUS-DP

The table below gives a summary of the technical features and the figure on the next side shows the bus cycle time of a Profibus-DP system.

Summary Technical Features Summary Technical Features PROFIBUS-DP	
Transmission Technique: PROFIBUS DIN 19245 Part 1	• EIA RS 485 twisted pair cable or fiber optic; • kbit/s up to 12 Mbit/s, max. distance 200m at 1.5 Mbit/s extendible with repeaters.
Medium Access: hybrid medium access protocol according to DIN 19245 Part 1	• Mono-Master or Multi-Master systems supported; • Master and Slave Devices, max. 126 stations possible.
Communications: Peer-to-Peer (user data transfer) or Multicast (synchronization)	• Cyclic Master-Slave transfer and acyclic Master-Master data transfer.
Operation Modes:	• Operate: cyclic transfer of input and output data; • Clear: inputs are read and outputs are cleared; • Stop: only Master-Master functions are possible.
Synchronization: enables synchronization of the inputs and/or outputs of all DP-Slaves	• Sync-Mode: Outputs are synchronized; • Freeze-Mode: Inputs are synchronized.
Functionality	• Cyclic user data transfer between DP-Master(s) and DP-Slave(s); • Activation or deactivation of individual DP-Slaves; • Checking of the configuration of the DP-Slaves; • Powerful diagnosis mechanisms, 3 hierarchical levels of the diagnosis messages; • Synchronization of inputs and/or outputs; • Address assignments for the DP-Slaves over the bus with

	Master class 2; • Configuration of the DP-Master (DPM1) over the bus; • Max. 244 bytes input and output data per DP-Slave, typical 32 bytes.
Security and protection mechanisms:	• All messages are transmitted with Hamming Distance HD=4; • Watch-Dog Timer at the DP-Slaves; • Access protection for the inputs/outputs at the DP-Slaves; • Data transfer monitoring with configurable timer interval at the DP-Master (DPM1).
Cabling and Installation	• Connecting or disconnecting of stations without affecting other stations.

Bus cycle time of a Profibus-DP Mono Master system(2 bytes I/O data/slave)
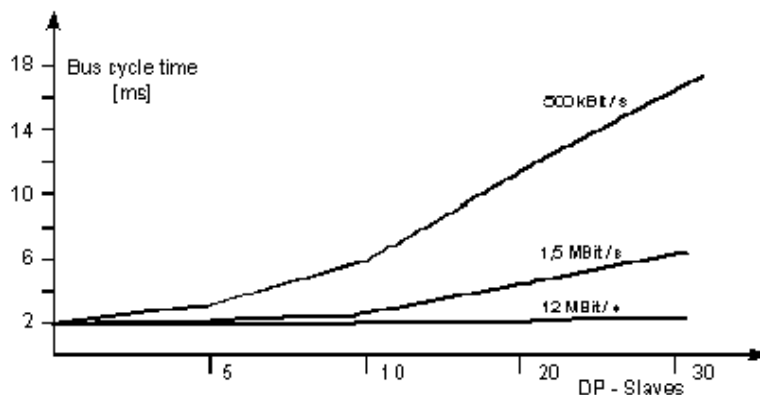
11.4 PROTOCOL & SUPPORTED FUNCTIONS

• Fieldbus type: PROFIBUS-DP EN 50 170 (DIN 19245);
• Protocol version: ver. 1.10;
• Protocol stack supplier: SIEMENS;
• Extended functions supported: Diagnostics & User Parameter data, accessed via mailbox frame;
• Auto baud rate detection supported. Baud rate range: 9.6 kbit-12Mbit;
• Hardware prepared for DP-V1 extensions;
• Save/Load configuration in Flash supported.

11.5 PHYSICAL INTERFACE

• Transmission media: Profibus bus line, type A or B specified in EN50170;
• Topology: Master-Slave communication;
• Fieldbus connectors: 9 pin female DSUB, as standard;
• Cable: Shielded copper cable, Twisted pair;
• Isolation: The bus is galvanically separated from the other electronics with an on board DC/DC converter. Bus signals (A-line and B-line) are isolated via optocouplers;
• Profibus-DP communication ASIC: SPC3 chip from Siemens.

11.6 CONFIGURATION & INDICATIONS

- Address range: 1-99, extendable to 1-126 via mailbox frame.
- Input/Output/User Parameter data/Diagnostics format defined via mailbox initialization frame.
- Maximum cyclic I/O data size: 244 bytes in, max. 244 bytes out, max. 416 bytes total.
- Maximum User Parameter data/Diagnostics length: 237 bytes.
- Bus termination switch onboard.
- LED-indications: ON-line, OFF-line, Fieldbus related diagnostic.

11.7 DATA EXCHANGE

- Compatibility with the existing ANYBUS® modules: Only compatible with other AnyBus-S modules.
- I/O data transmission: The module only supports cyclic.
- I/O data transmission. Acyclic data transmission(DP-V1) will be available in a later state.

11.8 INSTALLATION & CONFIGURATION

11.8.1 Fieldbus Connectors

The Profibus-DP standard EN 50170 (DIN 19245) recommends the use of a 9 pin female D-sub connector. Depending on the protection class and type of application, other connector designs are also allowed.

Guideline: If the module should be used with larger data transfer rates than 1500kbit/s, the D-sub connector is recommended to use.

D-SUB

Pin	Name	Function
1	Not Connected	-
2	Not Connected	-
3	B-Line	Positive RxD/TxD according to RS 485 specification
4	RTS	Request To Send *
5	GND BUS	Isolated GND from RS 485 side *
6	+5V BUS	Isolated +5V from RS 485 side *
7	Not Connected	-
8	A-Line	Negative RxD/TxD according to RS 485 specification
9	Not Connected	-

þ +5V BUS and GND BUS are used for bus termination. Some devices, like optical transceivers (RS485 to fiber optics) might require external power supply from these pins. RTS is used in some equipment to determine the direction of transmission. In normal applications only A-Line, B-Line and Shield are used.

11.8.2 Baud Rate

The baud rate on a Profibus-DP network is set during configuration of the master and only one-baud rate is possible in a Profibus-DP installation. AnyBus-S Profibus-DP module has an auto baud rate detection function and the user does not have to configure the baud rate on the module. Baud rates supported by the AnyBus-S Profibus-DP module are:

Baudrates supported by AnyBus-S Profibus-DP
9.6 kbit/s
19.2 kbit/s
93.75 kbit/s
187.5 kbit/s
500 kbit/s
1.5 Mbit/s
3 Mbit/s
6 Mbit/s
12 Mbit/s

11.9 TERMINATION

The end nodes in a Profibus-DP network has to be terminated to avoid reflections on the bus line. The AnyBus-S Profibus-DP module is equipped with a termination switch to accomplish this in an easy way. If the module is used as the first or last module in a network the termination switch has to be in ON position. Otherwise the switch has to be in OFF position.

NOTE!
If an external termination connector is used the switch must be in OFF position. Always use an external termination connector.

Termination switch ON	Bus termination enabled If the module is the last or first module, the bus termination has to be set on, or an external termination connector has to be used.
Termination switch OFF	Bus termination disabled.

11.10 NODE ADDRESS

Before configuring the AnyBus-S Profibus-DP module the node address has to be set. This is done with two rotary switches on the module, this enables address settings from 1-99 in decimal format. Looking at the front of the module, the leftmost switch is used for the ten setting and the rightmost switch is used for the setting of the integers.

Example:
Address = (Left Switch Setting x 10) + (Right Switch Setting x 1).

PLEASE NOTE: Another way of setting the node address is via the mailbox frame.

FB_SET_NODE_ADDRESS. The node address range is then extended to 1-125.

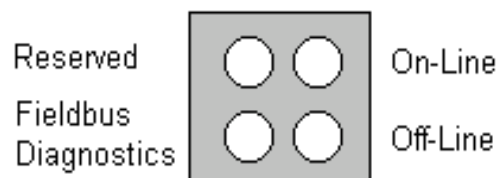PLEASE NOTE: The node address can not be changed during operation.

11.11 GSD FILE

Each device on a Profibus-DP network is associated with a GSD file, containing all necessary information about the device. The network configuration program during configuration of the network uses this file.

The latest version of GSD file can either be downloaded from the webpage   http://www.hms.se/ or received by contacting HMS.

11.12 INDICATIONS

The module is equipped with four LEDs mounted at the front and one LED on the board, used for debugging purposes. The front LEDs can be mounted in two ways, either top mounted or angle mounted. The function of the LEDs are described in the table and figure below.

11 PROFIBUS-DP

Name	Color	Function
Fieldbus Diagnostics	Red	Indicates certain faults on the Fieldbus side. **Flashing Red 1 Hz** - Error in configuration: IN and/or OUT length set during initialization of the module is not equal to the length set during configuration of the network. **Flashing Red 2 Hz** - Error in User Parameter data: The length/contents of the User Parameter data set during initialization of the module is not equal to the length/contents set during configuration of the network. **Flashing Red 4 Hz** - Error in initialization of the Profibus communication ASIC. **Turned Off** - No diagnostics present.
On-Line	Green	Indicates that the module is On-Line on the Fieldbus. **Green** - Module is On-Line and data exchange is possible. **Turned Off** - Module is not On-Line.
OFF-line	Red	Indicates that the module is OFF-line on the Fieldbus. **Red** - Module is OFF-line and no data exchange is possible. **Turned Off** - Module is not OFF-line.

11.13 ADDITIONAL INFORMATION ABOUT PROFIBUS-DP

þ The connector of the MFW-01 to Profibus-DP is a DB-9 that must be special for the connection of two cables.

þ Connections supported by the board AnyBus-S Profibus-DP

- 1 Polled I/O

NOTA!

MFW-01 has been developed to operate in Exchange Polled I/O operation mode with optimized number of I/O.

Please find below an example using a Profibus-DP network with a ZE-200 DP CPU (CL-200) from Bosch:

The module must be configured in file MFW.GSD in C:\Bosch\WinSPS\GSD\Profibus\Dp\Gsd\MFW.gsd with an ASCI editor for:

- Input _xxx Words .... equal to the number of inputs.
- Output _xxx Words..........equal to the number of outputs.

This means that you must configure exactly the same number of inputs in word that will be used as reading by the master and exactly the same number of outputs in word that will be used as changes by the master. See Item 5.2

Please consider all bytes up to the address of the last desired variable, the same that has been configured in MFW.exe.

To optimize the system relating to the number of variables that are available in the network, thus requiring the updating time, MFW-01 has been developed to program itself to the same number of I/O-variables that have been programmed in MFW.exe in addition to the status and control words.

NOTE!

If the number of I/O is not compatible, there will be no data exchange nor acknowledgment of MFW-01 in the Profibus-DP network.

11.14 PROBLEMS AND SOLUTIONS FOR PROFIBUS-DP

þ Please find below some problems that can occur with the MFW-01 in Profibus-DP networks

Problems:	Solutions:
No communication in Profibus-DP:	þ Check if the file .GSD is installed correctly in the used programmer; þ Check if the number of I/O is compatible with the programmed one in MFW-01, see Item 10.14 e 5.2; þ Check if the address of MFW-01 is configured correctly; þ Check if the Baud rate of MFW-01 is configured correctly in the Profibus-DP programmer; þ Check if the connections are correct in the Profibus network to the MFW-01, see Item 11.9.1; þ Check the enabling of the serial communication in Profibus-DP network by the Master of the network.

12 PROBLEMS AND SOLUTIONS

Problems:	Solutions:
Power LED OFF:	þ Check if the power supply is OFF or if Fuse F1 is open. þ Check the power connections, see Item 3.2.2.
Digital outputs are not activating:	þ Check if there is writing in the word relating to the digital outputs, see Item 5.2 e 5.2.1; þ Check if the are enabling in the control word, see Item 5.2 e 5.2.1. (Control 00h = 0000 0011b); þ Led ON, but contact does not establish connection, check connectors, see Item 7.4.
Digital inputs are not activating:	þ Internal power supply: • Check if the internal aux. 24V power source is supplying ~24Vcc, see Item 7.4; • Check if there are no external loads connected to the power supply, see Item 7.4; • Check if the detectors that are used at these digital inputs are supplying standard voltage levels, see Item 7.1.1. þ External power supply: • When external power supply is installed, use only OV as reference, +24Vcc must be connected only to the inputs, see Item 7.4; • Check if the external 24V power supply is supplying ~24Vcc, see Item 7.4; • Check if the detectors used at these inputs are supplying the standard voltage levels, see Item 7.1.1.
No communication at subnet:	þ Serial interface LED does not flash: • Check if the MFW-01 is in RUN mode; • Check if the Fieldbus communication has been established; • Check if there are enablings in the control word, see Item

	5.2 e 5.2.1.
	þ Serial interface LED flashes and there is an error indication of the serial interface.
	• Check the serial communication cables, EIA/RS-232 or EIA/RS-485;
	• Check all connected equipment and their respective communication cables;
	• Check the programming realized in MFW.exe V2.00, check if the program is transferred successfully.
Serial error indication at subnet	þ Check through the status words to determine which equipment is defective, and check the connection with the respective equipment;
	þ Through the status word of the respective equipment, check which type of error is present and then search for a possible solution;
	þ Through their parameter, check if the addressing is correct (equipment address within subnet);
	þ Check the programming realized in MFW.exe v2.00, check if the program is transferred successfully.
	NOTE: Changing errors will be indicated in the status words and error LEDs until a new changing is sent and it is accepted. Remember that specific communication protocols write only in the output area if variables are changed.
Random indications of serial errors in the subnet:	þ Check all serial cables in the subnet and their respective shields;
	þ Check if all grounding points are grounded correctly;
	þ Check if only the terminations of the subnet are connected with terminating resistors and if are connected;
	þ Check all EIA/RS-232 connection cables that must hold as short as possible and must be laid separately from all other cables that are not intended for serial communication, see Item 6.2 e 6.2.4.

13 FREQUENTLY ASKED QUESTIONS

þ This section presents answers for the main questions that rise during instalation and programming MFW-01 fieldbus gateway.

How many equipments can I connect to only one MFW-01 ?	• It depends. MFW-01 has the capacity to exchange until 48 words of reading and writing. Thus, the maximum quantity of equipments that one can connect to only one MFW-01 is function of this value. If, for example, we wish read and write 12 parameters from an equipment, we could connect, at most, 4 equal devices to only one MFW-01.
How is the physical connection between MFW-01 and the equipments of the subnet ?	• There´s two possibilities; EIA/RS-232 e EIA/RS-485. RS-232 allows only short distances point-to-point connections (10m at most), while RS-485 multi-point connetions until 1000m.
What protocols are supported in this subnet ?	• There are two possible protocols, WEG protocol (WEG products only) and Modbus-RTU (third party manufactures). The choice of what will be used in the subnet is configured with MFW.exe v2.00 configuration software. Remember that only one can be present. It´s not possible to mix equipments with different protocols or adjustements (like baudrate and parity type) in the same network.
What products can be connected to the gateway MFW-01 ?	• Any product that have support at least one protocol, WEG or Modbus-RTU.
What is the read/write scan totat time in the subnet ?	• This time can vary according to the number of parameters/basic variables exchanged between subnet master (MFW-01) and the equipments connected to it. Greater words, larger it´s the time spend to update all of them. Equations to count this time are shown in section 5.2 and 5.3.
When should I use MIW-02 ?	• Always when my equipment has EIA/RS-232 interface only and I wish to put it in a EIA/RS-485 standard network. It will be responsible to adapt different level signals to each standard. Remember that each MIW-02 can be connected to only one equipment, since conversion is realised point-to-point.

What kind o cable is used to link one equipment to the MFW-01 ?	• Cable description to this cable is done in itens 6.2.4 and 6.2.5. This is the standard WEG serial cable. It can be used to link MFW-01 to equipments and MIW-02 to equipments.
What type of cable can I use to build a network whose follows EIA/RS-485 standard ?	• This standard doesn´t define a specificc cable. It only suggests some caracteristics that may be follow to guarantee quality of connections made. Tips to choose this cable are presente in item 6.1.4.

PRODUCT WARRANTY
TERMS TO MFW-01

WEG AUTOMAÇÃO

WEG Indústrias S/A - Automação, established at Av. Waldemar Grubba No. 3000 in Jaraguá do Sul – Santa Catarina – Brazil - warrants WEG products against defects in workmanship and materials under the following conditions:

1.0 For the effectiveness of this warranty it is essential that the purchaser inspects carefully the purchased equipment, immediately after receipt, checking its characteristics and following its installation, adjustments, operation and maintenance instructions. The equipment will be considered as accept and approved automatically by the purchaser, when the purchaser does not give written notice within maximum five days after the receipt of the product about verified non-conformities.

2.0 The warranty period is for twelve months from the invoice date of the equipment issued by WEG or its authorized distributor, but limited to twenty four months from the manufacturing date, that is indicated on the product name plate.

3.0 In case the equipment fails to function or operates incorrectly during the warranty time, the warranty services will be carried out, at WEG discretion, at its head office in Jaraguá do Sul – SC, or at WEG Authorized Repair Shops.

4.0 The failed product must be available to the supplier for a required period to detect the cause of the failure and to make the corresponding repairs

5.0 WEG Automação, or its Authorized Repair Shops will analyze the returned inverter and when the existence of the failure covered by the warranty is proved, it will repair, modify or replace, at its discretion, the defective product without cost to the purchaser, except as indicated in Item 7.0.

6.0 The present warranty responsibility is limited only to repairs, changes or replacement of the supplied equipment. WEG will have no obligation or liability

whatsoever to people, third parties, other equipment or installations, including without limitation, any claims for loss of profits, consequential damages or labor costs.

7.0 Other expenses as freights, packing, disassembling/ assembling and parameter setting costs will be paid exclusively by the purchaser, including all fees, ticket, accommodation and meals expenses for technical personnel, when needed and/or requested by the customer.

8.0 The present warranty does not covers the normal wear of the product or equipment, neither damages resulting from incorrect or negligent operation, incorrect parameter setting, improper maintenance or storage, operation out the technical specification, bad installation quality, or operated in ambient with corrosives gases or with harmful electrochemical, electrical, mechanical or atmospheric influences.

9.0 This warranty doe not covers parts or components that are considered consumer goods, such as rubber or plastic parts, incandescent bulbs, fuses, etc.

10.0 This warranty will be cancelled automatically, independently of any previous written notice or not, when the purchaser , without previous written authorization by WEG, makes or authorizes third parties to make any changes or repair on the product or equipment that failed during the warranty period.

11.0 Repairs, changes, or replacements due to manufacturing defects will not stop nor extend the period of the existing warranty term.

12.0 Any request, complaint, communication, etc. related to the product under warranty, servicing, Start-up, etc., shall be send in writing to the following address: WEG Automação., Att.: Servicing Department, Av. Pref. Waldemar Grubba, 3000, 89256-900-Jaraguá do Sul – SC – Brazil, Fax: (55 47)372-4200, e-mail: 0800@weg.com.br

13.0 The Warranty granted by WEG Automação. is conditioned by the observation of this warranty term that is the only valid warranty term for the good.